73 Amateur Radio

APRIL 1965
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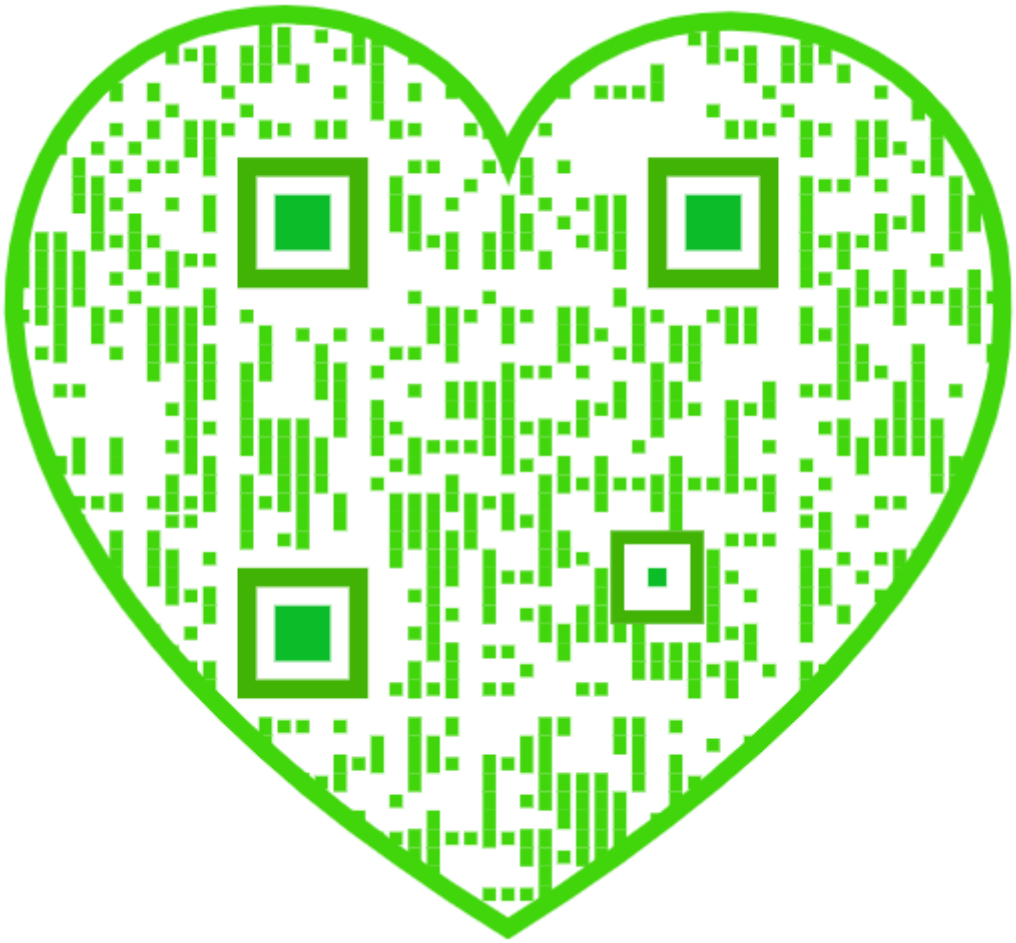

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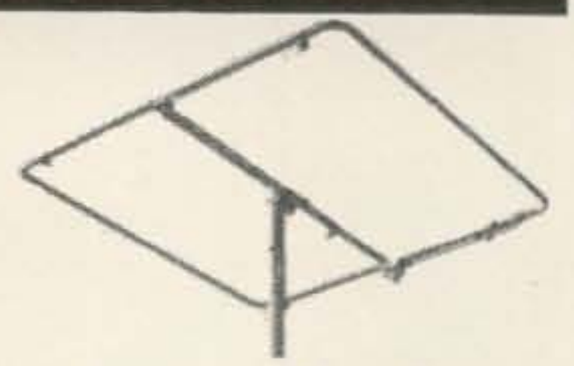

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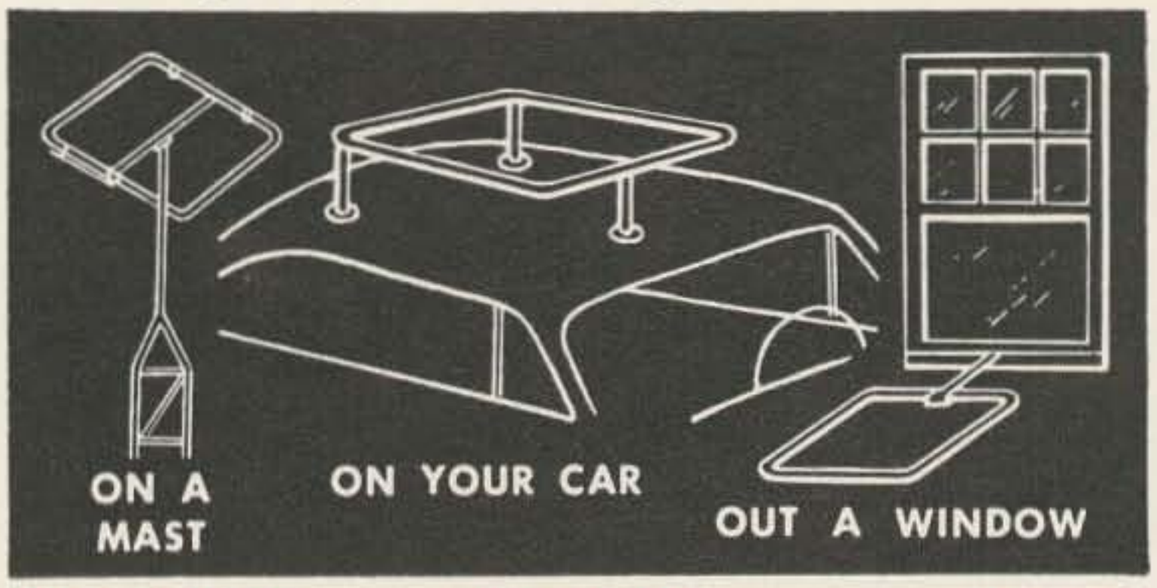

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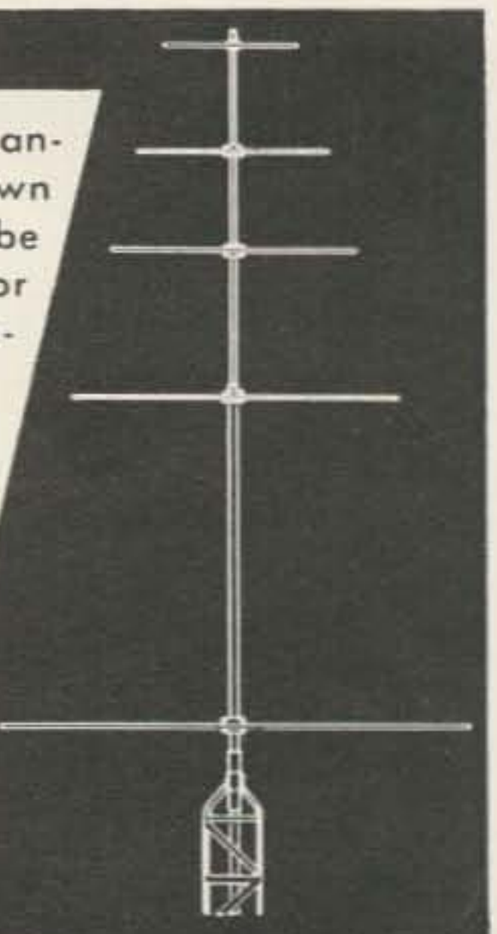

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73

Magazine

Wayne Green W2NSD/1

Editor & Publisher

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Assistant Editor

April, 1965

Vol. XXX, No. 1

Europe on Two? W7SMC/6 3
Get ready for Oscar III.

Letter from Gus W4BPD/AC5H 4
Beginning 73's monthly letter from the DX King.

1 KW PEP W9EWL/Ø 6
811's in a small box.

6 Meter Heterodyne VFO Transmitter K1CLL 10
A imple, stable, easy-to-build transmitter from Bill.

Kostless Keyer W8MQW 14
Well, maybe not kostless, but klose to it.

Double Hula K2ICF/6 16
A small new antenna. Looks like a halo, but good for HF.

Propagation ..... Nelson 20
Looks like an interesting month

Special SSB Transceiver Section 22
All the dope on all the HF SSB transceivers.

IoAR News WA4PDX 32
What's new with the Institute.

Versatile Code Monitor W8GXU 34
Transistorized with p.c. board, yet.

432 mc Noise Generator W6GXN 38
So you think *your* converter has a noise figure of 3 db?

KWS-1 on VHF W4API 44
It adapts easily for use with transmitting converters.

Amateur, Spare that Meter W8BPY 48
And a chuckle with K3SUK.

Transistor RF Power Amplifier Design WA2DJU 52
This month's technical article is a first in the ham field

Some Worthwhile Seneca Modifications K6VNT 56
To improve its fine performance.

Two Meter Low Noise Transistor Converter ..... Rohde 62
From our European correspondent.

A Novel AFSK Oscillator K8ERV 66
For the VHF RTTY'er.

Signal Generator for VHF and UHF K1CLL 70
You'll have to turn to page 70 for the real title.

Converted Converter W3ZFJ 74
Turn that old converter into a receiver.

73 Tests the Galaxy V W2NSD/1 78
And is happy with it.

Unusual Philological Diversion K2PIJ 80
Sometimes known by other names.

Caveat Emptor? 92
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De W2NSD/1 2
KWM-1 on LSB 45
High Power Swan 240 46
Marsy SB-33 46
New Products 55
Letters 64, 82

de W2NSD/1

never say die

OK fellows, I've got you right where I want you. While I've been pot shotting away at the ARRL from up here in the wilds of New Hampshire from my lofty perch on 73 Mountain, my cohorts have been busy making arrangements for me to step in and take over the League and run amateur radio as my own personal empire.

My man on the ARRL Executive Committee has thrown dust in the other eyes . . . a simple matter, really . . . and that detested Article 12 of the ARRL Articles of Association has been thrown out the window. I thought we might have a battle getting it dumped, but there was nothing to it. I sat up here telling them how awful it would be to have Dannals on the Board of Directors and they went ahead and moved heaven and earth and got him on.

Article 12? Oh, that was that old hangover from the early days of ham radio when everyone worried that someone would use the League for commercial purposes.

Article 12 states: "No person shall be eligible for the office of Director, Vice-Director or President who is commercially engaged in the manufacture, sale or rental of radio apparatus capable of being used in radio communication or commercially engaged in the publication of radio literature intended in whole or in part for consumption by radio amateurs."

So I had to wait until they threw that one out before I could announce for Director, and scheme my way, with some inside help, onto the Executive Committee. He, he.

Article 12 stood in the way of Dannals being accepted, so Article 12 got the axe instead of Dannals. Now, as seems absolutely certain, if the Board of Directors seats Dannals as the Hudson Division Director at the May Board meeting, the rule will have been completely bypassed. Dannals, you see, works for Sperry Gyroscope at Lake Success, New York. According to the Electronic Engineer's Master, Sperry makes the following radio apparatus capable of being used in radio communication: Aircraft communications systems, airport traffic contro systems, microwave communications systems telemetering systems, microwave transmitters radar transmitters, telemetry transmitters, VLF UHF and VHF transmitters, beacon, command, direction finding, interrogation loran microwave and UHF/VHF receivers. Obviously Dannals is intimately engaged in the specific activity that is prohibited by Article 12 OK, so the Directors have a choice of throwing out either Dannals or Article 12. How about that Vice-Director, Stan Zak K2SJO? Well Stan works for Madam Bell, that ubiquitous gal who is even more involved in manufacturing, sale and rental of radio communications equipment than Sperry. With over 7% of the Hudson Division members of the League dropping out last year, perhaps they don't need any representation anyway.

K6BX Really Does It

For some months now I have been devoting quite a few spare moments to a compilation of facts which are under the working title of the "ARRL Black Paper." This accumulation of data, letters, bulletins, statements, etc., all document in considerable detail events which the League headquarters is trying desperately to keep secret. Few amateurs realize the extent that the ARRL is ruled by commercial interests, for instance.

So along comes a twenty-two page exposé of ARRL management from Clif Evans K6BX that makes my effort look puny. Clif, in his usually pungent style, quotes at length from confidential letters written by directors to other directors and assistant directors, exposing plots and events that would be considered completely unbelievable if they were not thoroughly documented. This is an incredible tale of corruption and callous disregard for the ARRL membership that will shake the League to its core.

Frankly, I would like to print some of the material here so you could see the fantastic extent that things have gone, but Clif has the

Continued on p. 86.

Robert N. Tellefsen, W7SMC/6
277B Tyrella
Mountain View, California 94041

Europe on Two?

Oscar III will make a number of firsts pos- ble. Will a trans-Atlantic QSO in the 2-meter and be one of them? There is a chance that is will be possible with the help of this ama- eur Telstar.

When Oscar's I and II were in orbit, their ltitudes were about 250 and 270 miles, re- pectively, and they were heard by tracking tations at distances of more than 1000 miles. f they had been repeating satellites, contacts would have been possible between stations more than 2000 miles apart; how much more s difficult to estimate. Analysis of observation eports on Oscar's I and II shows that Oscar I vas heard by stations on the east and west oasts at the same instant, giving a range of bout 2200 miles.

How does this make trans-Atlantic 2-meter ontacts possible? The range prediction for Oscar III, more than 2000 miles, is based on he Oscar's I and II observation reports, and n the assumption that the altitude of the Oscar III orbit will be similar to the altitudes f the Oscar's I and II orbits. These represent ear minimum altitudes, since a satellite placed n a lower orbit would not remain there long. Oscar II, with an apogee of 249 miles, re- ntered the earth's atmosphere before com- pleting 300 orbits.

Obviously more altitude will be necessary o enable contacts between the U. S. and Eu- rope, but not much more, since the distance rom New England to Great Britain is be- tween 2500 and 3000 miles. A 300-mile high orbit would do it. If the Oscar III orbit is higher than those of its predecessors, or if the Oscar III orbit is similar in altitude to the Oscar's I and II orbits but more elliptical, trans-Atlantic contacts should be possible.

The contacts would be at extreme range and so would be short, probably similar to meteor scatter contacts, lasting perhaps a min- ute or so at a guess. Prearranged schedules would be a necessity for contacts, but anyone monitoring the satellite output frequencies might be able to hear a European or two, most likely in England, Scotland, or Ireland.

A kilowatt would be helpful, as would a good antenna mounted high with a good view of the Atlantic horizon. The antenna need only rotate in azimuth, as the satellite will be trav- elling along the horizon.

The Oscar III frequencies are as follows: input pass band 144.075 to 144.125 mc, out- put pass band 145.875 to 145.925 mc, tele- metry transmitter output 145.85 mc, and the coherent beacon output 145.95 mc. Frequency inversion takes place within the satellite, so a signal at the low end of the input pass band will come out at the high end of the output pass band. A signal entering the satellite at 144.080 mc would come out at 145.920 mc, and so on. Also, due to the frequency inver- sion, signals passing through the satellite will have their sidebands reversed. Upper-sideband SSB will come out as lower sideband, and RTTY signals would have their mark and space frequencies reversed when using fre- quency-shift keying.

To determine when Oscar III will be in common view of an English and a U. S. sta- tion, see the article on an orbit predictor in the March issue of 73. As a line between the two stations becomes more perpendicular to the path of the satellite track across the sur- face of the earth, the possible length of con- tact will increase.

No-one can promise that trans-Atlantic con- tacts will take place, but the possibility is there. Will you be the first to work Europe on 2 meters?

. . . W7SMC/6

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Letter from Gus

Feb. 5, 1965
Dechencholing, Bhutan

I suppose many of the DX gang has been wondering about why I did not show up in AC land before now. Well that's a story all by itself. You ask anyone who ever tried to get that all important "Innerline Permit." About all I can say is this was the toughest one that I have ever tackled. Peggy and I were at the point of leaving Calcutta any number of times because it was really touch and go all the way, even though things I thought had been pretty well fixed a long time before we left the U.S.A. In fact I thought they were all OK even before I departed from here early last Spring. Well many things have been happening in this section of the world, and many of these things have a strong tendency to not encourage permits to be issued to visitors, even though I had been here before and had made good friends with many of the high officials. It's a very long story, much too long to tell in a few words. Eventually I hope to get around to the whole works.

Well we arrived at Phuntscholing, Bhutan on the 21st. of Jan. with no equipment. My equipment was due to arrive from N. Y. on about the 27th. To this day it is still not here. We departed from Phuntscholing, Bhutan for here on Feb. 1st. We arrived here on the 2nd. Boy, may wife Peggy almost had a fit on that mountain road. If you can picture a narrow unpaved mountain road that's only 127 miles, that takes 2 days to cover you may have some idea of what she went through even though she had taken 2 tranquilizers, aspirins, and a few other nerve controlling medicines. When you leave Phuntscholing you go about one city block and "Slam Bang" you are in the mountains. The road starts by going uphill, with hair pin curves about every 100 feet, and it just keeps on going up and up and up, with the sheer drop offs getting deeper all the time. Every time I have made this trip it seems to give me another thrill and I have now made it 7 times. I am on the air with AC5PN's transceiver which will tune just 2 kc from my operating frequency. I am expecting my good equipment anytime now.

Tell the fellows to call me very close to my frequency, call **down** the band but not over 3 kc at the most. I will indicate when to call me further than this. Will be on 7 mc and 3.5 mc in a few days with a good antenna. Boy the band sure is stinko. But it's still W3CRA S8 when the other fellows are at the best S4 or 5. It has been Long Path from 1145 to 1330 GMT. No W6's or 7's yet at all. I am really going to work on my antenna and try to get a better signal. I am surrounded by mountains, being in the middle of the Thimphu Valley. Long path looks good so far. Trying 0100 to 0300 GMT—also but no soap yet. Two VE8's only.

. . . Gus

Gus' Travels and Tribulations

This is the first installment on Gus' current activities. We hope, mail service permitting, to have a letter every month from Gus telling what he is hearing and what is going on in the DX world. In addition to this letter we will start next month with a regular series of articles on Gus' adventures. 73, the new DX magazine.

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FM-5000 with batteries, accessories and complete instruction manual, less oscillators, and crystals. Shipping weight: 18 lbs. Cat. No. 620-103 . . . . . $375.00
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The International C-12M is a portable secondary standard for servicing radio transmitters and receivers used in the 2 mc to 15 mc range. The meter has sockets for 24 crystals. The frequency stability is ± .0025% 32° to 125°F, ± .0015% 50° to 100°F. The C-12M has a built-in transistorized frequency counter circuit, AM percentage modulation checker and modulation carrier and relative percentage field strength.

C-12M complete with PK (pick-off) box and connecting cable, batteries, but less crystals. Shipping weight: 9 lbs. Cat. No. 620-104 . . . . . $235.00
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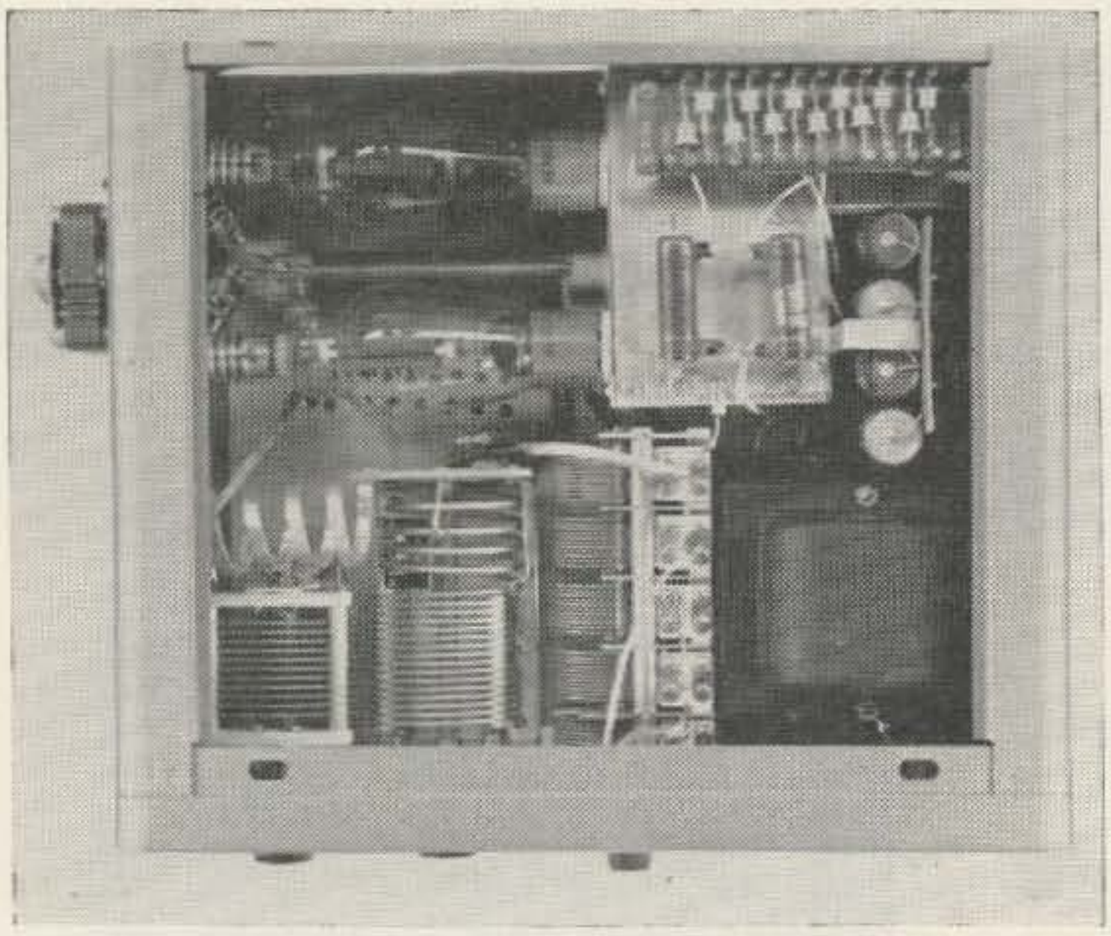
In an amazingly short number of years, the emphasis on amateur radio gear has changed from "the bigger the better" to "let's have it neat and compact as possible." This amplifier was designed primarily to be used with one of the many fine tranceivers on the market today. For this use, we felt that certain requirements were definitely in order: 1. The amplifier should be small and neat in appearance so as not to disrupt the order of the household. 2. It should be easily driven by and compatible with the transceiver. 3. It should run enough power to make it worthwhile. 4. It should be bandswitching. 5. It should be inexpensive and practical to build. 6. Last but not least, it should be challenging but not impossible to build. This amplifier is the size of the SR-150; is driven to full output with about 30 watts; runs 500 watts DC input (that's 1000 watts PEP); is fully bandswitching; uses common parts; has a total cost under 100 dollars; and is certainly not beyond the scope of the average builder with a little ingenuity.



Top view of Small Fry.

The adequate driving power of most transceivers suggests grounded grid operation. The 811A is a proven favorite and it has established a reputation as a lot of tube for the money. The B&W tapped coil was chosen because it is compact, relatively inexpensive, provides an acceptable Q on all bands, and is a very easy way around the problem of bandswitching. One could use a roller inductor coil, but this necessitates the need for a counter dial. However, the nice thing about using the roller inductor is that L-C ratios can be juggled to have optimum operating efficiency on each band.

The loading condenser is a five gang, 425 pf per section variable condenser that was obtained at the local surplus house. This condenser has been advertised by many of the surplus houses across the nation and should not be difficult to obtain. Three gang broadcast variables are readily available from any supply house and could be used, but some loading flexibility would be sacrificed. The five gang variable is set up in such a way as to provide using two sections alone or a total of five sections after switching in the other three sections when more output capacitance is required. This gives a tunable capacitance range of 850 or 2125 pfd and eliminates the need for messy switchable capacitors. A B&W FC-15 filament choke is used to isolate the filament transformer so that the driving power is applied directly to the filaments (cathode)

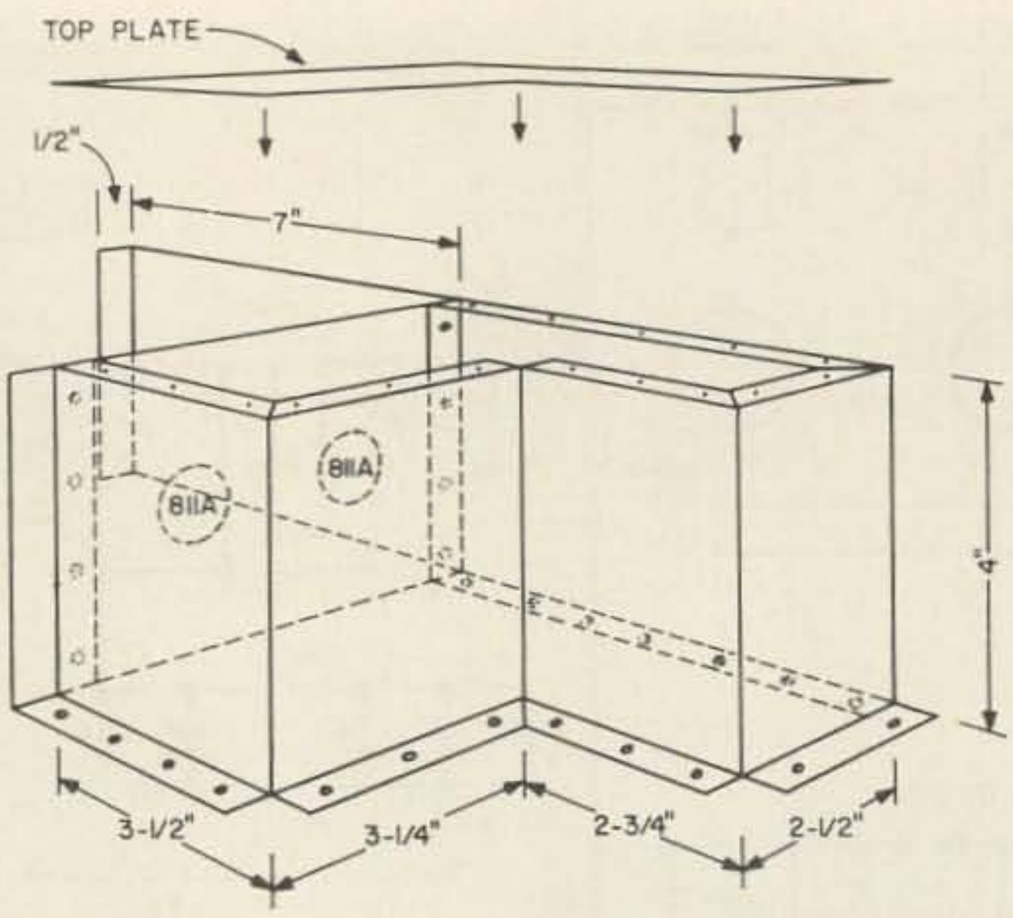
hrough a .01 mf disc ceramic. The metering s in the negative side of the plate supply and erves as a check on the operating conditions of the amplifier.

It seems that the rage today is to pull a KW ut of an old TV power transformer and a handful of petite, inexpensive silicon diodes. A KW is questionable; but at 500 watts DC input, the transformer that was used barely gets warm. This transformer is from an old Philco twin-chassis TV set and is rated at something like 540 volts at 360 ma and has three filament windings of considerable amperage, which were not used in order to lessen core saturation when high amperage is drawn from the transformer. Most any old TV power transformer could probably be used, and old TV sets are available for almost a dime a dozen. One word of caution: Color coding of the transformer leads are different on the transformers in different sets, so take note when removing the transformer or check out the windings with an ohmmeter before automatically wiring it up using standard color codes.

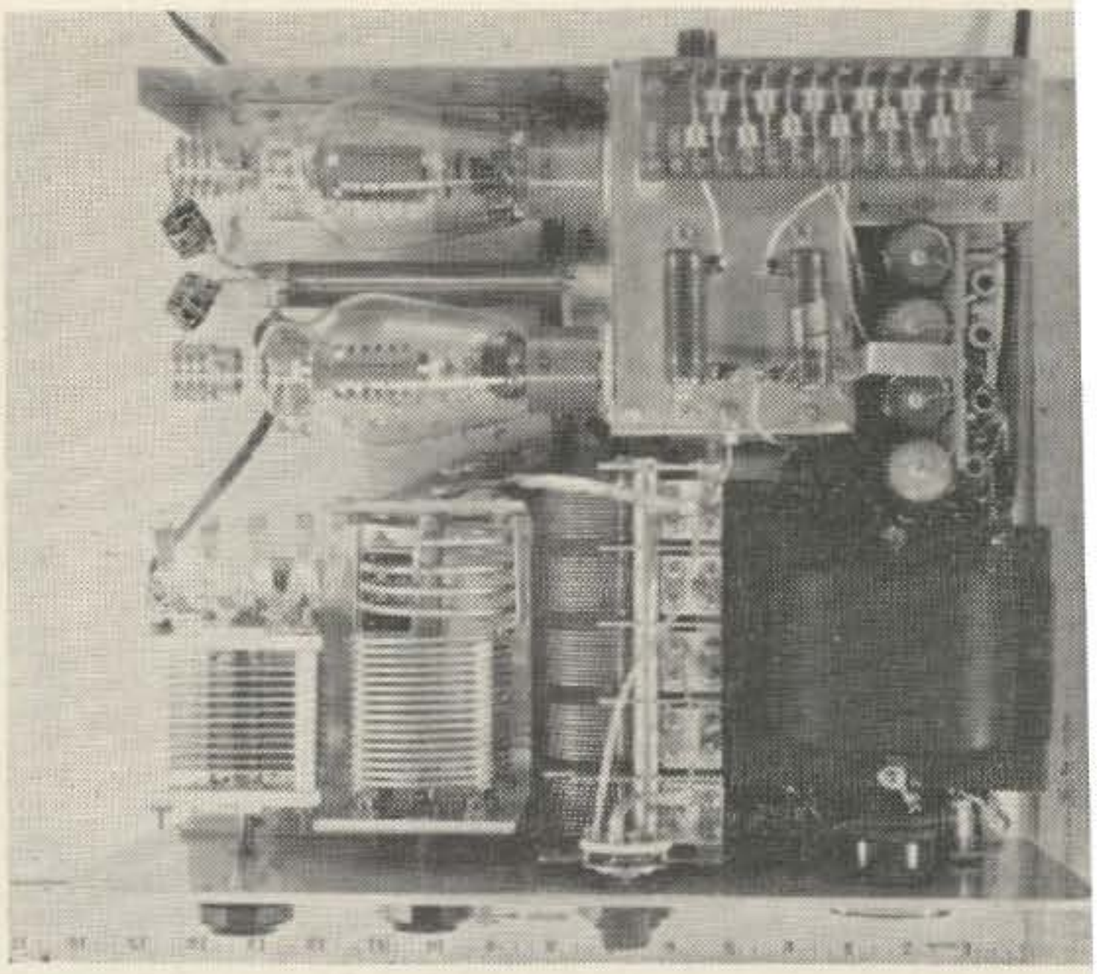
The diodes used in this instance (because they happened to be on sale) were 400 PIV at 500 ma. Six diodes were used in each leg of the voltage doubler. The diodes were rated by the manufacturer at 140 volts rms. 6×140 equals 840 volts which gives more than enough safety factor for the diodes. 470k-½ watt resistors and .01 μf 1000 wv disc ceramics are connected across each diode in order to compensate for variations in the characteristics of the different diodes. The 50 ohm-20 watt resistor in series with each leg provides protection for the diodes from abnormal surge currents such as those encountered when first turning on the high voltage with the filter capacitors in an uncharged state. Four 100 μf 450 wv electrolytics are used, and this gives a quite respectable value of 25 μf on the output of the power supply. 25k-20 watt resistors across each electrolytic work as both equalizing resistors and as a bleeder. No, we didn't forget the filter choke. It is certainly not needed, particularly with a voltage doubler. The voltage delivered is 540×2.82 (peak AC voltage factor for a voltage doubler) which is 1523 volts theoretically. Actually, there is about 1550 volts delivered from this particular transformer; and this drops to about 1400 volts under a 350 ma load. A fused plug is incorporated with 8 amp fuses in each leg of the AC line.

Construction

It must be confessed that the cabinet was the starting point for construction. It is always more fun (and also more work) to start with a



Construction of shield box.



Top view of a cabinet.

certain size box and then try to cram everything into it. The cabinet used in this instance was the same as that used to house the Hallicrafters SR-150. It should be no problem to have a good sheet metal man construct a cabinet from light weight steel or to build a cabinet using Reynolds' ¾" angle stock and do-it-yourself perforated aluminum. Styling is up to you.

The front panel and the chassis plate were cut from 3/16" aluminum plate stock. Standard ⅛" aluminum panel available in any supply house should be fine though. The front panel and the bottom plate are mated with a piece of ¾" aluminum angle. It was surprising, but more than adequate strength was present in this instance without the use of side braces.

The initial problem of shielding the grid and filament circuit was solved by the sheet metal man down the street (at a cost of $2.50). The L shaped box was constructed of light sheet aluminum as shown in the drawing. This box is mounted to the bottom plate with ¼"-6/32 screws tapped into the bottom plate.

At this point, may it be noted that instead of using nuts on the mounting screws, the holes in the bottom plate were tapped with a 6-32 or 8-32 tap so that protruding nuts on the bottom would not prevent the assembly from easily sliding into the cabinet.

This L shaped box provides just enough room for the filament choke, the filament transformer and the tube sockets. The leads from the filament transformer (AC primary, pilot light, and center-tap) are passed through rubber grommets on the side facing the power transformer. The coax connector for the input to the amplifier is mounted on the back side of the box. The grids of the 811A's are directly grounded by bending the pin down and soldering to the frame of the tube socket. The box is flanged as noted, and an aluminum plate is fastened to this flange by small ¼" metal screws to complete the top.

The power transformer is mounted directly in front of this L-box using two lengths of 8-32 threaded stock through the core to the bottom plate. By using the L shaped custom aluminum box, we have a cutout just large enough to hold the four electrolytic condensers and their equalizing resistors that have previously been mounted on a 3½" × 5½" × 1/16" phenolic board. The resistors are mounted on the phenolic board facing the outside in order that they might have adequate ventilation. This condenser-resistor assembly is mounted by using a small piece of aluminum angle to the bottom plate and is braced at the top by a small ⅜" aluminum strap connected to the L-box. There is just enough room between the power transformer and the front panel to provide space for the filament and plate switches, the pilot lights, and the plate meter.

The top plate on the L shaped aluminum box is used for the mounting of the surge resistors and the bank of silicon diodes. A piece of 1/16" phenolic board is again used with the diodes mounted on the top side and the 470K ohm equalizing resistors and the .01mfd capacitors mounted on the underside. This assembly is mounted on four one inch porcelain standoff insulators. The 811A's are mounted horizontally as shown in the photograph with the plate choke mounted horizontally and somewhat below the tubes. The blocking capacitor is mounted on a porcelain insulator that is fastened to the bottom plate. The tuning condenser, plate coil, and loading condenser are mounted side by side as shown in the photograph. The two condensers are mounted

n aluminum spacers in order that the shafts ill all be at the same level. There is just nough room directly above the loading con-enser to mount the ceramic switch for switch-ng the ganged sections of the loading con-enser. Copper strap (actually the outside hield of RG-59U coax pressed flat) is used to onnect the plate tuning components together. short piece of RG8U coax is used to connect ne coax connector on the back aluminum late to the B&W coil. This runs close to the ottom plate and under the tubes and RF noke.

A small phonograph motor with a three ch fan blade is mounted on the cabinet and lows directly on the tops of the 811A's to pro-ide ventilation and cooling. A series of ¼" oles are drilled into the bottom plate directly nder the tubes to provide for additional air ow. Heat dissipating type connectors are al-o used to help keep the tubes cool.

Check for parasitic oscillations on twenty nd fifteen meters. We finally wound up with ve turns of #16 enamel wire around two 100 hm 2 watt resistors in parallel for parasitic hokes in the 811A plate leads. One may have o experiment with the number of turns on ne resistors but the least number that one an get by with is best. This amplifier is cer-ainly wild without the chokes in the plate eads though.

The static plate current for the 811A's un-er these conditions is approximately 60 ma. he amplifier should be loaded as heavily as ossible into the antenna and then talked up o 300 to 350 ma plate current wise which is ne optimum full load operating condition. late meter readings are sometimes confusing ut are not much good for tuning purposes. It suggested than an SWR bridge or output neter be used for tuning and everything tuned or maximum output.

In using the amplifier with a transceiver, a ransfer switch is needed. We used an old DPDT relay with ceramic insulation and about 0 amp contacts. This is mounted in a small Bud mini-box and the coaxial leads brought ut directly to coax connectors that connect to he transceiver, the amplifier, and the antenna r SWR bridge. We have encountered no ifficulty with this lashup and it works fine. Ve would have liked to mount the relay in the nal but there just was not room. The ampli-er has been in use for a couple of months, s very adequately driven by the SB-33 and has given a good account for itself on all bands. We ave even given up on perhaps seeing the ittle silicon diodes go up in a whiff of smoke!

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Bill Hoisington K1CLI
Peterborough, N. H.

6 Meter Heterodyne VFO Transmitter

Compactron tubes have many advantages for ham use. They were developed for commercial applications where their main advantage is economy: They are squat tubes with 12 pins, set in an all-glass envelope. Because of the large number of pins, most Compactrons contain more than one unit. For instance, the 6J11 has two completely separate and shielded high gain if pentodes, each with a Gm of 14,000. That is high. Compare it with 4300 for the 6BA6! The 6D10 has 1½ 12AT7's in it. That's three good triodes of 2½ watts dissipation each. The 6M11 has two of these (12AT7) triodes and a 14k Gm type 6EW6 as well. In addition, the Compactrons have a large pin circle diameter for more insulation and higher plate voltage. Tube leads are also short and direct for good high frequency performance. You can see the many possibilities for amateur use.

I built a two tube VFO heterodyne transmitter using one Compactron. The final tube is an old 815, but could easily be one of the Compactron power tubes. The most interesting part of the circuit is the heterodyne, or conversion, VFO, where a stable 3 to 4 Mc variable oscillator is added to a 47 Mc crystal oscillator in a mixer. This avoids multiplying the VFO output, so the mixer output on 50 Mc will be very stable as the crystal oscillator can easily be made drift-free.

I started the transmitter with a 6AF11, which has a triode and a 6CX8 in it. This tube is very useful for the heterodyne circuit. As soon as I put the 12 pin socket in *one* hole, wired up *one* filament lead and soldered three cathode tabs to the tube ring, I began to appreciate the economy of labor involved with Compactrons. I checked the various sections of the 6AF11, which has two good triodes and a super-dooper video type pentode with five watt dissipation (almost a 5763). These tube people may be nervous about transistors, but they're not surrendering peacefully. Those triodes are good! The 47 Mc crysta oscillator starts off with only 8 volts plate volt age. And the pentode section puts out one watt of stable six meter energy even though it is acting as a mixer. All this is one smal bottle for $2.

Now to the details. I used the highest gain triode for the 47 Mc oscillator, since it needs the gain. When I build an oscillator, I always set up a good tuned plate circuit and pick up the least amount of out-of-phase energy possible to the grid. It has always worked well for me Fig. 1 shows the circuit. Simple, isn't it? L2 is inserted in L1. The coupling may be varied for tests but it is not critical. It is important to keep the plate voltage below 100 volts You can use a voltage regulator if you like, but I didn't find one necessary.

The Variable Oscillator

Here again, a good plate circuit is set up After all, it's the plate that generates the power. An airwound coil is used, tuned to 3 to 4 megacycles. There are some who maintain that the plate should be grounded to avoid "heat expansion trouble." They perhaps forget to mention that the plate-grid capacity is still present and would cause frequency shift if the plate did expand with heat. This one is stable, as is.

An air capacitor is used as a parallel pad to set the frequency on the dial. Here also you are interested in a certain amount of power. Don't forget, this is a transmitting circuit. C4 is a Hammarlund MAPC-100 with a screwdriver shaft. C3 is a Hammarlund MAPC-100B with ¼ inch shaft. They are air capacitors so they will not vary with temperature. C5 spreads the frequency out on the dial. The variable frequency control portion may be made a lot more fancy if you like, with slow-motion dial, switching for every half megacycle, etc. I just brought the shaft out with an insulating extender and put a long pointer knob on it.

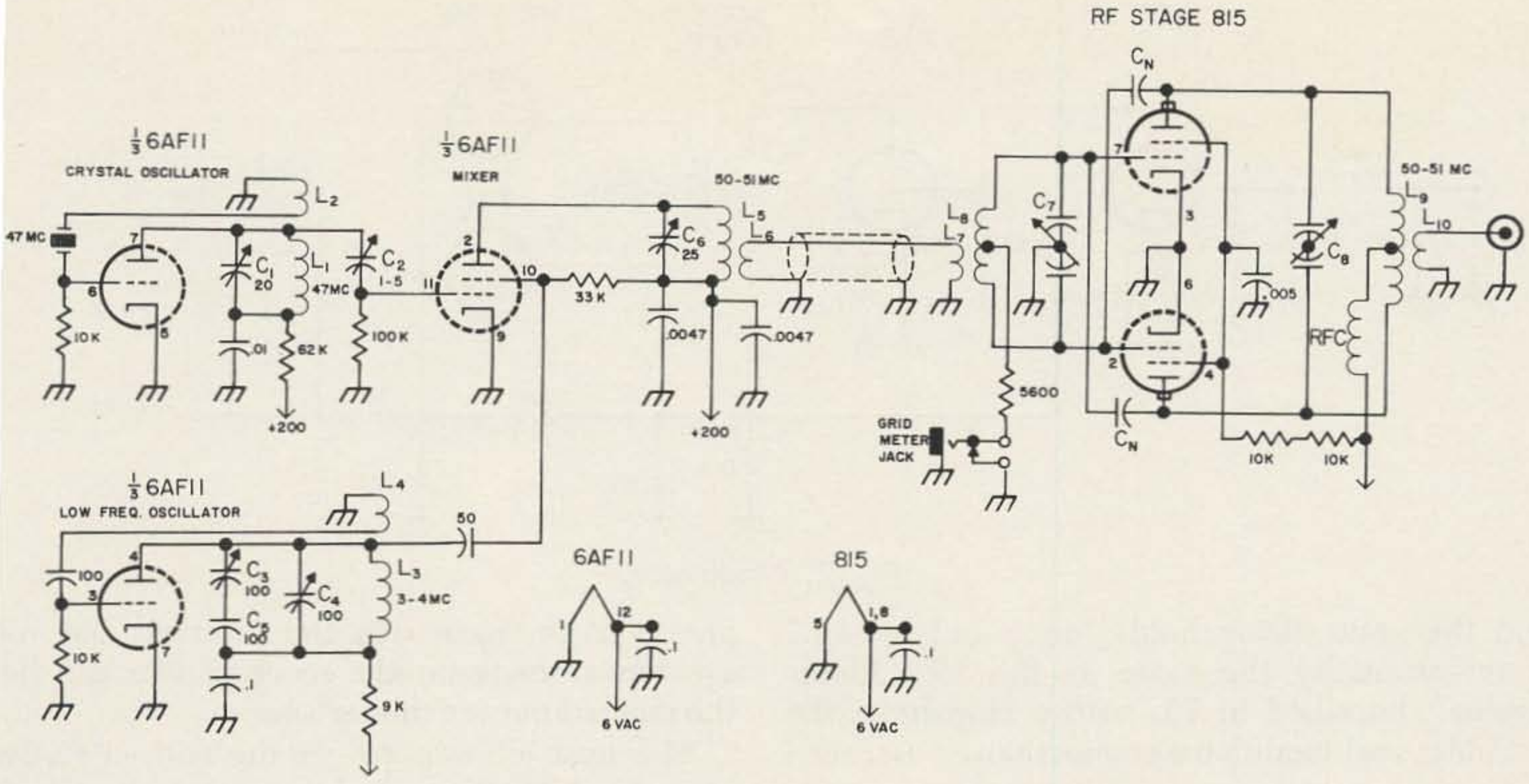

Fig. 1. 6 Meter Heterodyne Transmitter.

L1. 7 turns airwound, 16 turns per inch 5/8 in. diameter. B & W 3003, Air Dux 416T.
L2. 6 turns of plastic covered No. 22, 1/4 in. O.D., 3/8 in. long. Inside L1.
L3. 2 in. of 1/2 in. dia. 32 turns per in. B & W 3004, Air Dux 432T.
L4. 15 turns of No. 28 dcc wound on cold end of L5.
L5. 13 turns airwound 8 tpi.
L6. 2 turn adjustable link over cold end of L5.
L7. One turn link near center of L2.
L8. 4 turns No. 14 enamel, 1 1/4 in. O.D. 1 in. long.
L9. 6 turns No. 14, 3/4 in. O.D., 1 1/2 in. long.
L10. 2 turns near center of L3.
C1. Hammarlund MAC-20.
C2. 1-5 pf mica trimmer.
C3. Hammarlund MAPC-100B. "Tune."
C4. Hammarlund MAPC-100. "Set."
C5. 100 pf silver mica.
C6. Hammarlund MAPC-25B.
C7. Hammarlund BFC-12.
C8. Hammarlund BFC-12.

The crystal oscillator is fed into the grid of ıe pentode mixer through C2, a 1 to 5 pf ıica compression capacitor. For adjustment of :2 first open it up and get the crystal oscil- ıtor running properly, with a gradual increase ı grid current (open the ground end of the rid resistor and put in a milliammeter) on ne side of resonance, and an abrupt drop on ıe other. The presence of the regenerative oil (L2) makes the operation much less criti- al, as you can check. As you increase the eedback of L2 you will see a greater region f power out and less abrupt drop. C1 hould tune to resonance near the middle of :s range. With the oscillator running proper- y, increase C2, putting more power into the ıixer grid. Too much C2 will knock out the rystal oscillator and cause self-oscillation of he pentode. It is very stable over the useful ange though.

The variable oscillator is coupled into the ıixer screen with a 50 pf capacitor. This sec- ion worked perfectly right away and has not lrifted since. It is very uncritical and very table.

The mixer plate is simply another good 50 Mc coil, tuned with a Hammarlund MAPC-25B air capacitor. With both oscillators running, 47 Mc and 3 Mc, peaks of energy will be found at 44, 47, and 50 megacycles, the sum and the difference of the two oscillators, and their fundamentals. The 3 Mc fundamental naturally does not show up in a 50 Mc plate circuit. I obtained about one watt out of the plate on 50 Mc. Do *not* ever use this on the air without at least two more tuned circuits, as the 47 Mc energy is only some 10 db down. Link coupling over to the final grid circuit of an rf amplifier, such as an 815, plus a good plate circuit on the 815, will result in the 47 and 44 Mc energy being way way down.

The RF Stage

Almost any good tube that will put out 25 watts or more and operate on 1 watt input on 50 Mc will do. I used my old favorite, the 815. It neutralizes easily and can be bought for as low as $1.75 surplus. Fig. 1 shows the circuit. It is quite standard; tunes up easily;

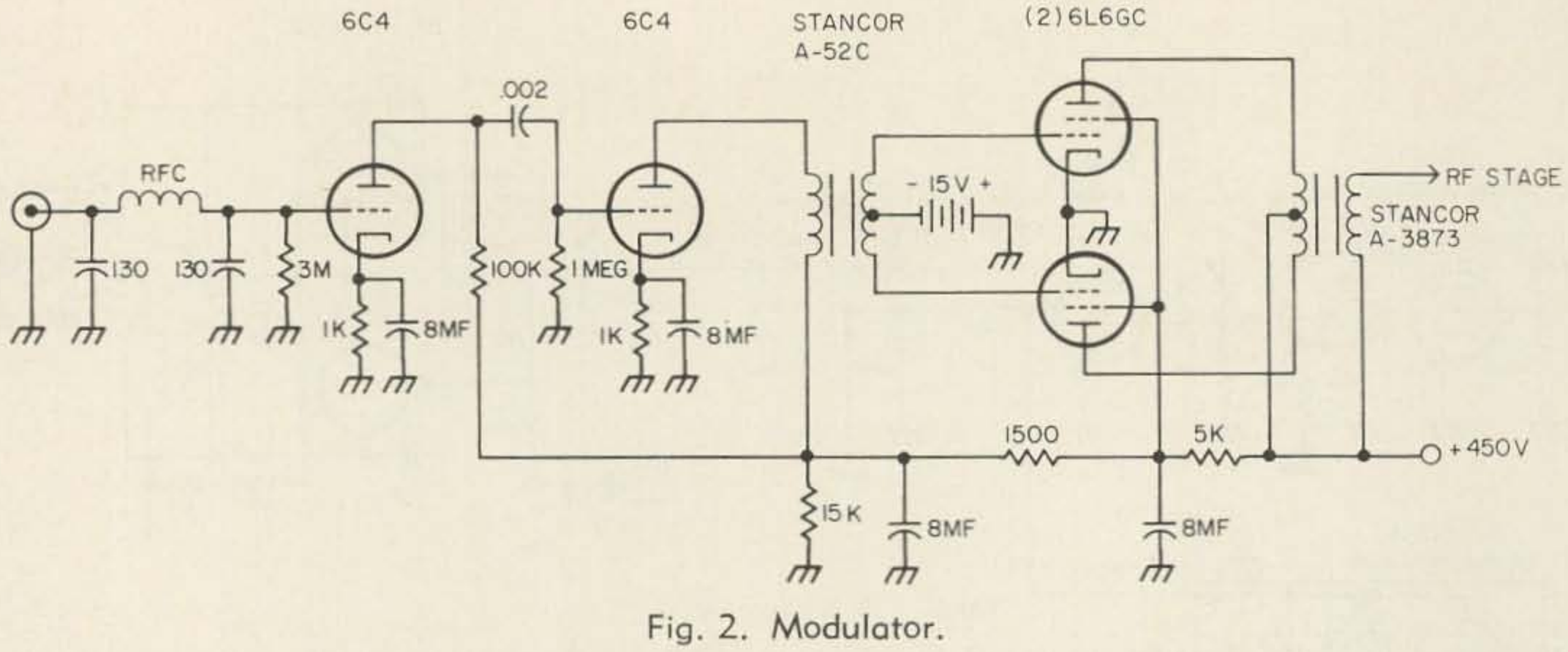

Fig. 2. Modulator.

and the neutralizing holds "once and for all." It is essentially the same as the "Six Meter Linear" described in 73, with a change in the grid bias and modulator connections.

The Modulator

Fig. 2 shows the modulator circuit. It works, and works good enough so that the modulation reports were "better than average," "clear as a bell," and "no trash or hash of any kind."

After getting the 6C4 driver stage running, I put another 6C4 in front and plugged in my low-cost Astatic mike. Immediately, rf feedback. This time I was able to cure it with an rf choke and two 130 pf capacitors between the mike jack and the grid. No feedback at any time since. The two 6C4's just about do the job, but only just. I'm going to put in a 6AT6, which has a much greater amplification factor.

On The Air Tests

This was interesting. I started about 3 pm on a weekday and everything was fine while talking to the student types (it was summer) and retired lads. "No drift," "FB," etc. About 5 p.m some working type operators began to show up on the band, with more money and thus more selective receivers. Some of these had *sharp* receivers and reported a slight but steady drift. So, off the air again and back to the bench. I checked the variable 3 Mc section. No drift.

I checked the crystal. Drift! Why the crystal oscillator? Well, as I have said many times, these VHF crystals will *not* stand over 100 volts on the plate of the triode. I put my voltmeter on the B-plus and sure enough,150 volts. My own fault. Increasing the dropping resistor and lowering the volts on the plate to 100 took out the drift nicely and no more drift has been reported since.

For frequency spotting, the 6AF11 power supply is switched on without the final. It puts a large signal into the receiver, but with a beam antenna on the receiver you can hear the desired carrier through it.

The next job was to get the entire "station" assembled on three shelves with a handle for portability. The top shelf has the converter, VFO, final and the transmit-receive switch. The middle shelf holds the modulator, and down below are the two power supplies. I took it up to 73 Mountain near Peterborough, N.H. for a 6 hour work-out. No drift reported at any time from a number of sharp receivers, and all modulation reports good to excellent.

Conclusion

Some interesting comments were heard. The appearance of a new home-brew rig on the air seems to be a rarity these days. And as for a single tube double-oscillator-converter VFO; well, very few that I talked to had any idea of what it was, even after I explained it. Apparently today the home-brewer type (of rigs, that is) is really scarce. The old division of customers into two distinct classes is becoming sharper. Class 1. Young lads, time on their hands to build, not enough money to buy ready-made gear. Class 2. The working type, busy making money, no time to build. This change over seems to be accompanied by the acquisition of an XYL and numerous junior oscillators I noticed this consistently when building beams, (UHF Resonator Co., Rye N. Y., 1946 to 1950). Class 1 types would ask for dimensions. Class 2 types would send checks for beams. Today with the heavy pressure on a young lad to get his education this deal is accentuated. He doesn't have much money while learning, and he has less time now as well. So maybe some new ideas on low-cost, easy-to-build, circuits, rigs, and beams going from 50 to 1296 megacycles may help. I'm trying anyway. And it's fun too!

. . . K1CLI

Here is what a Ham thinks about the new 6 meter base station antenna . . .

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A Kostless Keyer

All of us at one time or another have had a hankering to own a keyer. Some of us resisted the impulse because the cost outweighed the need. The circuit shown in Fig. 1 is my compromise. Although no claim is made that this keyer will replace a TO keyer, it does make self completing dots and dashes of uniform length at speeds from 9 to 35 wpm. Moreover, aside from the sensitive type relay L, most of the parts can be found in an average junk box.

The theory of operation is based on the fact that good condensers charge very fast. (See Fig. 1.) As the key is closed connecting the common and dot terminals, C_1 charges instantly (almost) to 9 volts, thus applying a charge to the base of T_1, causing current to flow through T_1 and closing the relay. But then as L closes, the 9 volts across C_1 is disconnected, allowing C_1 to discharge slowly and at a controllable rate across the speed control R_o. (See Fig. 2.)

Now for practical details. Many transistors were tried for T_1 and T_2, all with success. For instance, 2N168A and other general purpose types worked. However, if PNP's are used, the polarity of C_1, C_2, and E must be reversed. However, good condensers must be used for C_1 and C_2, (for instance the Sprague TE 1300 for C_2). As a rough guide, pick 10 to 50 wvdc types, *not* electrolytics. As for the speed control R_o and R_o', they must work on the same shaft and can be found surplus for less than .50¢; a distinct improvement would be the use of logarithmic tapers but this is not necessary.

The relay is the only rub. Whatever relay is used, it must have a coil resistance of 6 k to 8.7 k, and a closing current of .6 ma. The upper limit of 35 wpm is due to the slowness of the suggested Advance relay. On the other hand, this slowness provides a pleasing weight to the characters, although a weight control of a 20 k pot across L would be an improvement.

Adjustments of the ratio control and a means of constructing a cheap key are described in the 63 ARRL Handbook, page 253. The current drawn from the battery when the key is closed is at most 1 ma, depending on the speed, and .02 ma when the key is open (battery life is long indeed). As for the choice of dimensions of the box to enclose the Kostless Keyer, I leave that to the builder's taste and steadiness of hand.

. . . W8MQW

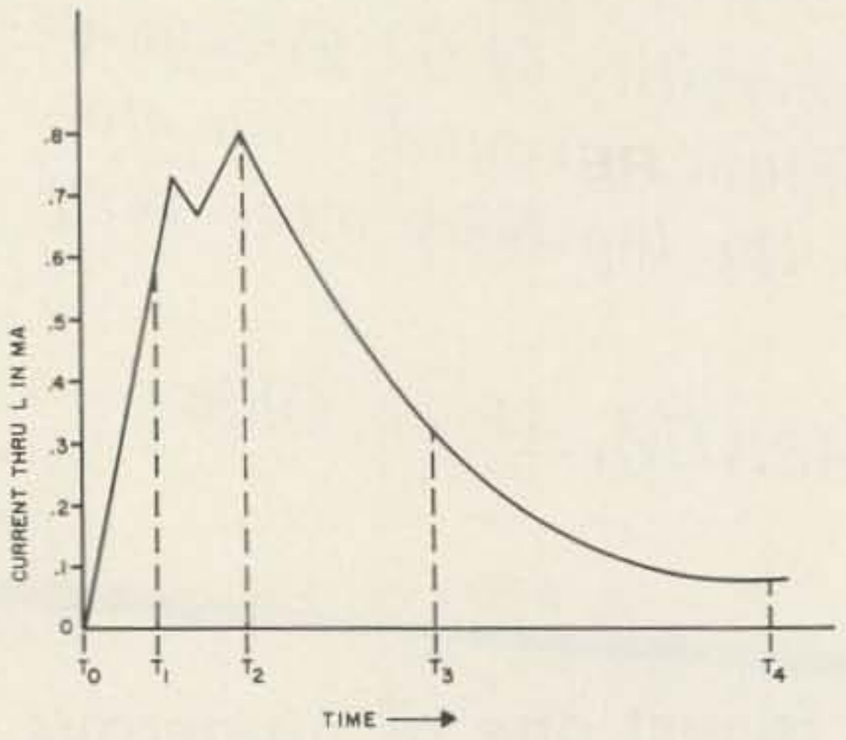
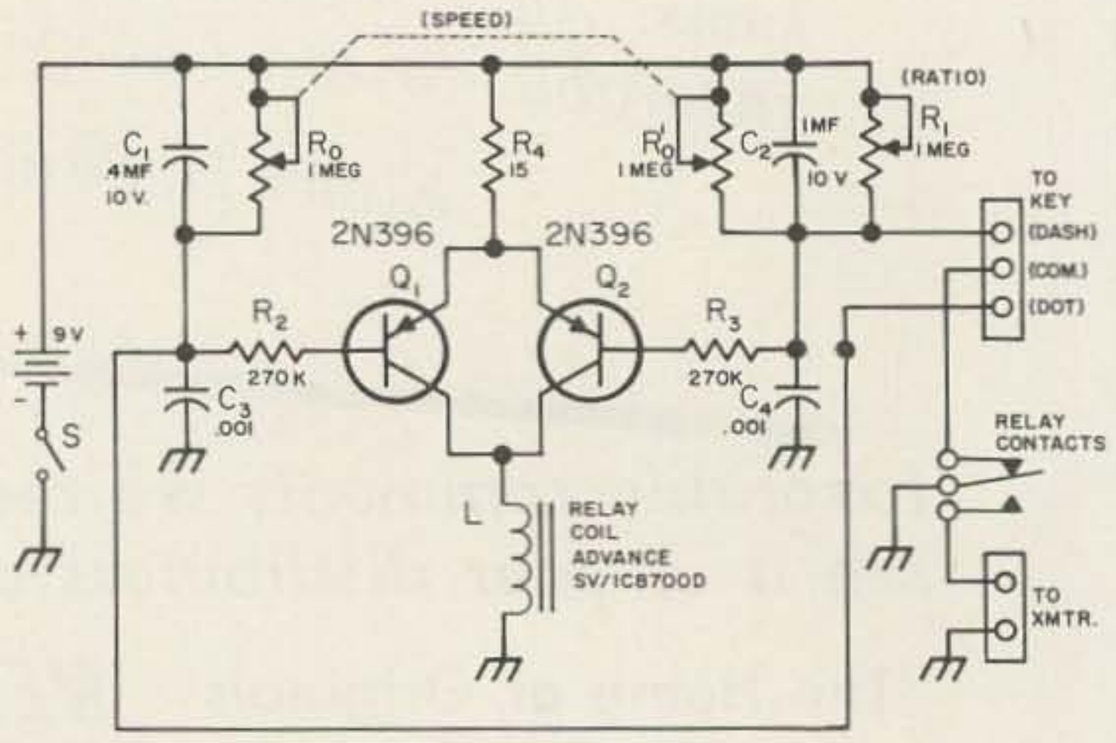


Fig. 2.

t_0: key is closed.
t_1: attains closing current.
t_2: L closes and keys transmitter.
t_3: release current, transmitter is off.
t_4: relay arm makes contact with open contact and the cycle repeats.



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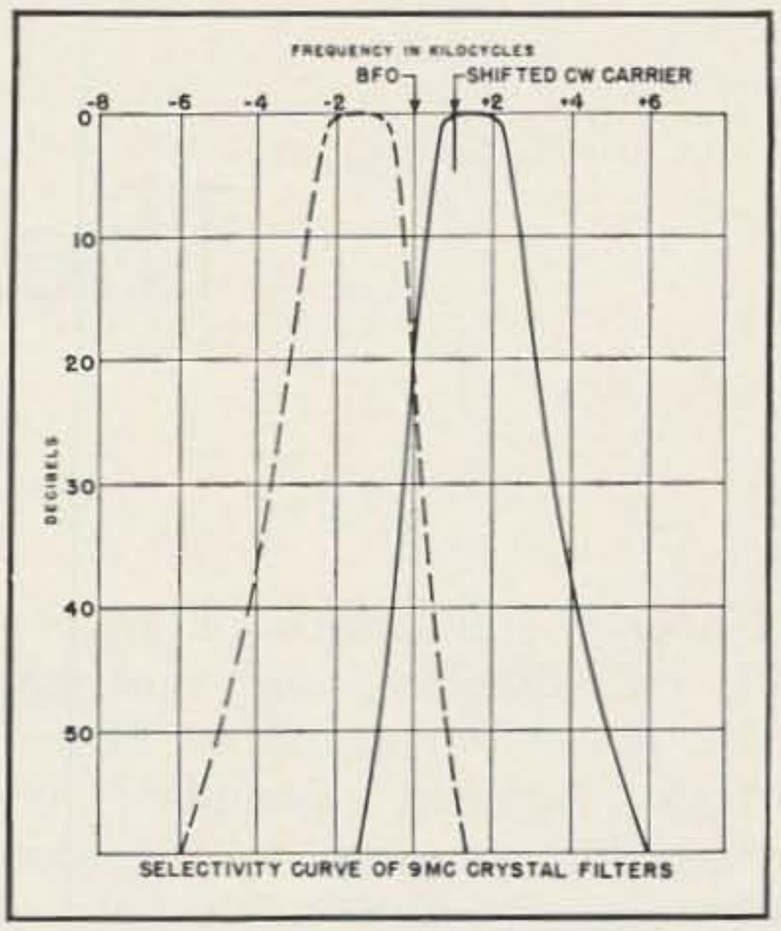

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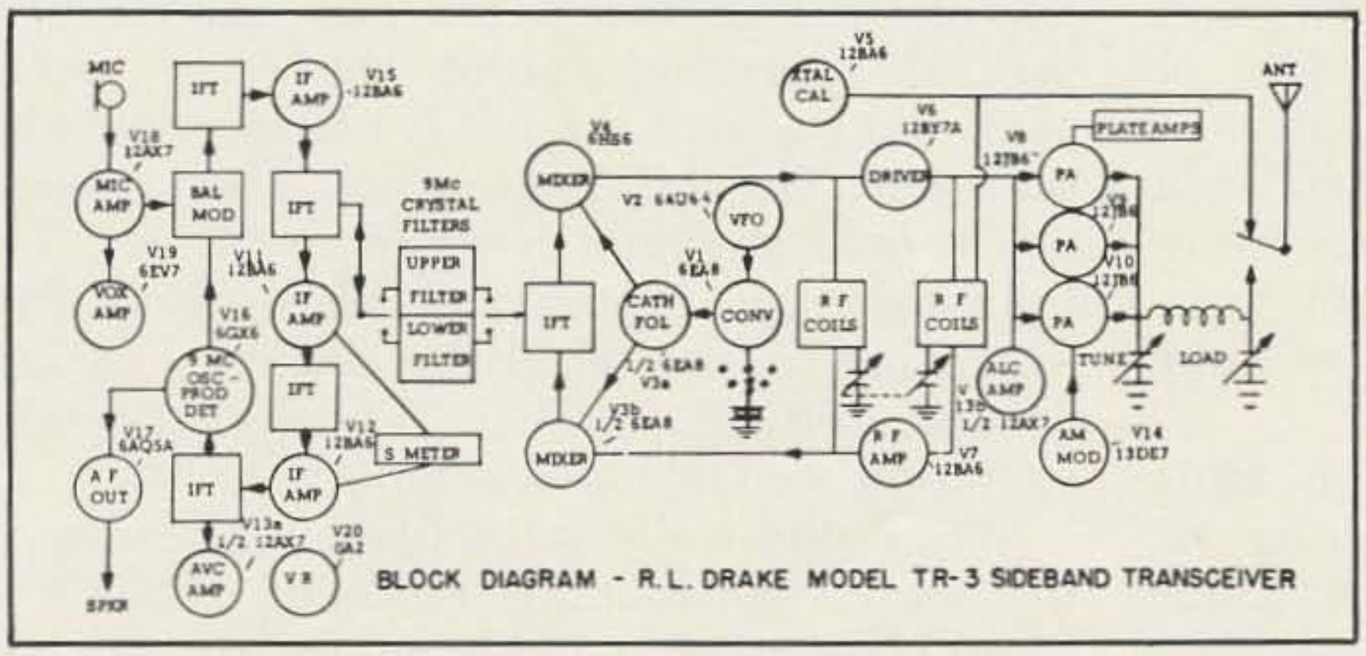

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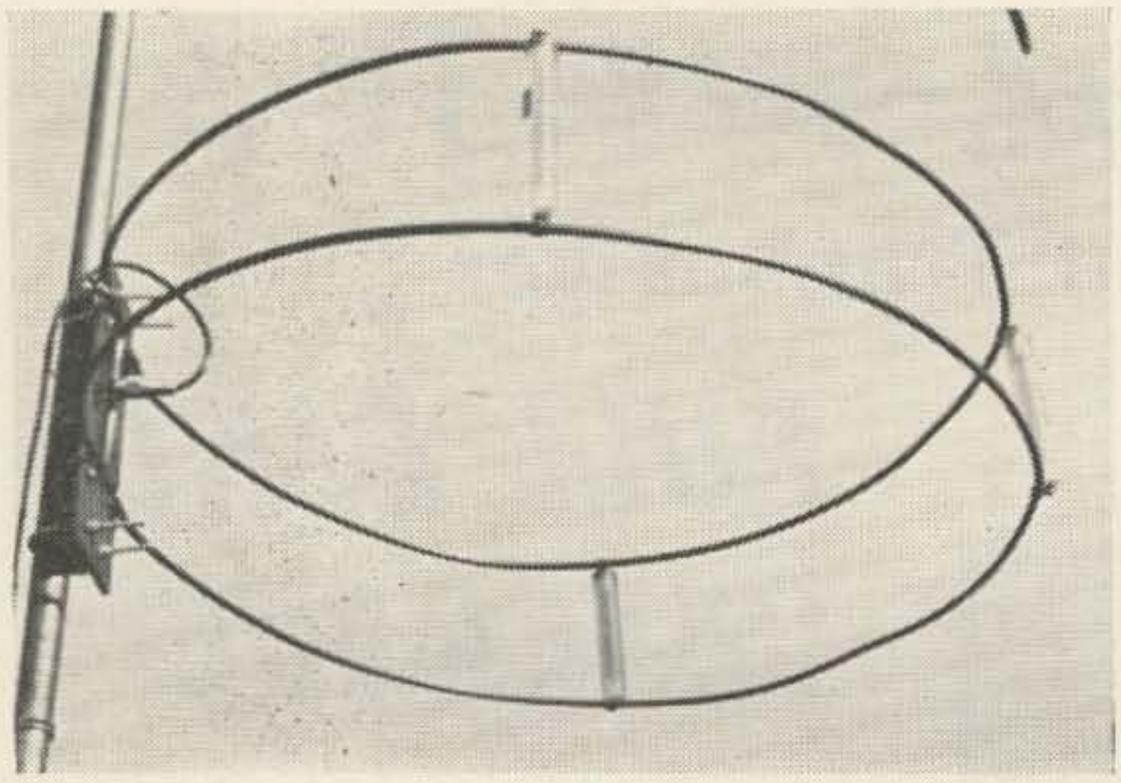

Peter A. Lovelock K2ICF/6
807 Fourth St.,
Santa Monica, Calif.

The Double Hula

Under the influence of zoning restrictions, TVI, cliff dwelling and unsympathetic landlords, many metropolitan hams have demonstrated frenzied ingenuity in contriving new designs for compact, inconspicuous antennas. Often enough, alas, paying the price of high losses, reduced capture area and low radiation efficiency, resulting in galloping frustration in trying to combat their full sized country cousins on our crowded bands.

A recent commercial innovation that offers remarkable possibilities to the huddled ham masses of suburbia and city is the 'Hula Hoop'. This new concept of radiator has already been introduced in several publications, and is known by the more conservative title of Directional Discontinuity Ring Radiator, a unique vertically polarized antenna utilizing a *horizontal* element mounted at almost zero height above its operating ground. In principle the Hula Hoop functions like a leaky waveguide.

In its originally reported form the Hula Hoop consists of a continuously circular radiating element, the circumference of which is equivalent to a quarter wave at the *highest* operating frequency. The circular element is mounted in a plane parallel to the operating ground-plane. A section of the radiator extends at 90 degrees to the plane of the circle at the driven end to form a short vertical leg, the length of which is shown as 'h' in *Fig.* 1, and the length of which is equivalent to the height above ground. The diameter of the hoop may be expressed as 28 electrical degrees at the highest operating frequency, while the vertical leg 'h' is 2.5 degrees. The radiator may be resonated downwards in frequency by increasing the series capacitance 'C' between the terminal end of the element and ground. In practice the Hula Hoop may be tuned over a 2:1 frequency range, permitting two band operation. However efficiency decreases sharply as resonance is lowered.

According to commercial tests the Hula Hoop is capable of radiating a field strength only 3 db less than a full size quarter wave vertical operating against the same ground plane. At one half the normal frequency, when resoanted by the appropriate series capacitance, field strength drops as much as 15 db from that by a quarter wave vertical. Even this is not so bad when the efficiency of some 'loaded' verticals used successfully for mobile operation are taken as a comparison.

While physically resembling it's cousin the half-wave, horizontally radiating 'Halo', beloved of six meter mobile enthusiasts, the Hula Hoop's functional characteristics are far from similar. The quarter-wave loop, in close physical and electrical relationship to a ground-plane, results in complete cancellation of a horizontally polarized field. The discontinuity effect of the radiating elements circular con-

guration causes it to act as a leaky wave-uide' with a highly efficient vertically polar-ed field.

One published construction article[3] de-ribes the application of the Hula Hoop for obile operation on ten meters or CB band, ilizing the car roof as an effective ground ane. This Hula Hoop is only 27 inches in ameter with height above roof (h) being a ere 3 inches. It is claimed to have outper-rmed a quarter wave whip mounted on the me vehicle.

For the suburbanite the Hula Hoop brings e opportunity of low-frequency operation on e current 75 and 40 meter DX bands, with-it having to erect a vertical radiator, the eight and appearance of which will unleash e wrath of neighbors and local officialdom. enough real estate is available to accom-odate a Hoop diameter of from nine to eigh-en feet, supported one to two feet above ound, the surrounding community may not en be aware he has an antenna. Or if they e, will conclude it to be the supporting ructure for a plastic swimming pool.

For the compact crowd, the Hula Hoop may ell be exploited on the higher frequencies, *oviding an adequate groundplane is avail-le.* Even at 20 meters the hoop diameter is ly a paltry 54 inches.

The author's own experiments with a car-p, ten meter prototype were extremely con-ncing. Half a dozen stations worked on ound-wave reported no discernible differ-ce on their S-meters between the hula and comparison mobile whip. The darn thing orks.

But what of the city-dweller without a con-enient ground-plane to hook his hula to. Or en his country cousin who wishes to hoist the la to dizzy heights without compromising compact qualities with bulky ground-plane ements. And let it be understood, on the ound, or in the air, the Hula Hoop requires highly effective ground-plane, so cast out ose slender ground rods and roll out the icken wire, you low-frequency DX'ers.

But wait, there is a solution. At K2ICF fixed cation, where it was desired to take the ad-ntage of height for ten meter RACES oper-ion over hilly terrain, top-of-the-mast oper-ion was the dilemma. Then came the blind-g inspiration for a ground-planeless Hula-oop and the Double Hula came into being. Since the conventional Hula-Hoop perched its vertical leg at height 'h' above the ound-plane sees a mirror-image of itself in e ground from which it derives its phase-g characteristics, why not replace the mirror

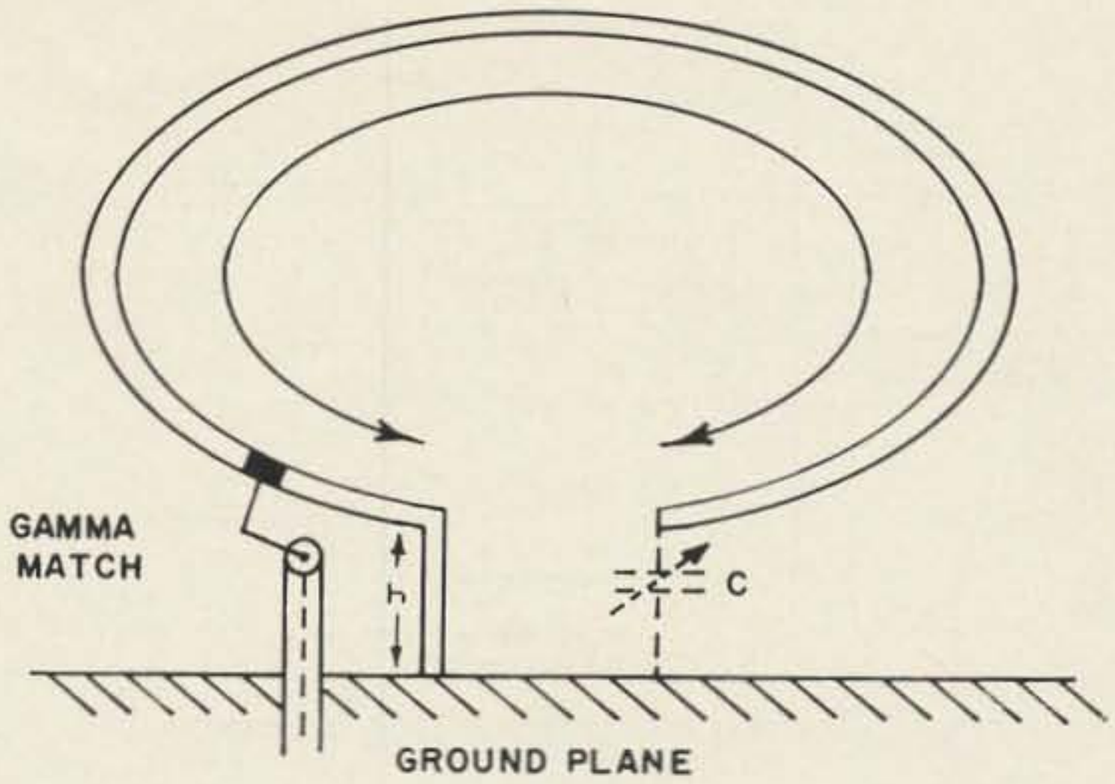

Fig. 1. Total radiator length L + h = ¼ wave at highest frequency. C = added resonating capacitor to lower frequency.

image with a physical twin. Why not, in fact, furnish a second Hula Hoop spaced 2h below the primary element and electrically connected by a common vertical leg. A doublet Hula?

No time was lost in acquiring a roll of automotive copper tubing ⅜ inch in diameter, and retiring to the basement to pound this into two parallel hoops spaced 6 inches apart by polystyrene rods. The mounting assembly shown in *Fig. 2*, was fabricated from a 10″ × × „9 ¼″ masonite board, to which the common vertical leg and hoop end were rigidly mounted with clamps made from ½″ copper strip. Variable capacitance was added to the terminal end of each hoop by 3″ lengths of copper strip extended from the mounting clamps adjacent to the vertical leg. The shell of a female coax connector was sweated to the mid-point of the vertical leg, and the center conductor connected by a short length of #14 gauge wire to a copper clamp spaced approximately 4″ along the upper hoop, to provide the required gamma match for the coaxial feedline.

The entire assembly was then wrestled to the roof of the station building (known to other family members as house) and was mounted with the traditional U-clamps to the mid-point of a rugged 12 foot mast that also supports the family TV antenna as shown in the photo.

As was expected the massive bulk of the TV antenna directly above the Double Hula had undesirable results on its radiation pattern, as apparently did the vertical mast extending both above and below the hoops, in the place of radiation. However this initial mounting did permit tune-up and matching adjustments, and close up photographing.

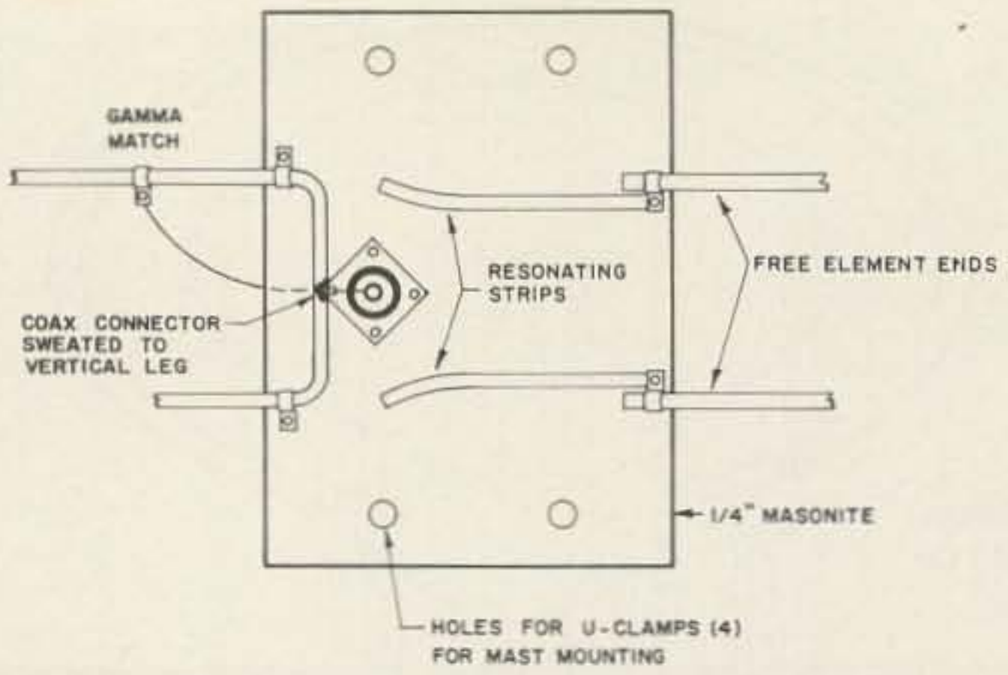

Fig. 2 Doubla Hula mounting assembly.

The assembly was resonated with a grid-dip meter by varying the proximity of the copper tuning strips to the vertical leg. Final pruning was accomplished by touching up the copper strips, using a long fibreglass rod, to obtain minimum standing wave ratio at the operating frequency of 28.7 mc. When this was accomplished the Gamma Match was adjusted to bring the swr close to 1:1.

Since initial tests indicated the Double Hula wasn't doing so well under its TV umbrella, it was then raised on an auxiliary mast section to a position located some 4 feet *above* the TV antenna. A recheck showed no significant change in resonance or swr.

But now ground wave signals were heard from New York City and Long Island some 35 miles away, as were strong skip signals from South America. Excellent contacts were had with mobiles at distances up to 40 miles using a ten watt transmitter, and locals reported improvement in signal strength over a commercial tri-band trap vertical mounted on the roof peak.

About this time, came a second blinding flash. If the Double Hula was functioning like a vertical half wave, would it work as a horizontal dipole if its plane was rotated 90 degrees, like a wheel on edge. After a struggle this new orientation was effected. Still no change in resonance or swr, and what's more it worked. Now we had the effect of a 16 ft. horizontal dipole packed into a compact wheel configuration only 27″ high and 6″ in length. At a pinch it could be made to work on 20 meters. But the equivalent of a 35 foot doublet would only be 54″ high and 1 ft. 'long.'

Now suppose we mounted another Doubl Hula spaced 0.2 wavelengths behind the firs could this be phased to act as a parasitic re flector. Visions of a full efficiency 20 mete beam comprising of three sets of 'ear-rings with a turning radius limited only by boon length danced through my mind. Unfortunate ly at this juncture the author ran out of time and with none foreseeable in the reason able future, decided to turn the whole concep over to those of the fraternity who have th freedom of hours to run amuck on roof-tops At least it had been proved that vertical o horizontal the Double Hula works and offer lots of opportunity for the experimentall minded, as well as practical joy for those wh are underprivileged in space.

A few words of caution. Excepting for th basic dimensions of the 10 meter hulas, th author has not attempted to determine exac dimensions for other frequencies, and thes should not be critical considering the capa bility of series capacitance resonance. How ever length of the circular elements shoul not exceed a quarter wave at the highest oper ating frequency desired, or capacitive res onance will not be possible. Height of th vertical leg (h) is approximately 3 inches fo 10 and 11 meters and may be multiplied di rectly for lower ham bands. The Q of th hula is high, and thus the bandwidth some what narrow. The Double Hula displayed broader bandwidth, and when resonant a 28.7 mc, could be operated from 28.5 t 29.3 with less than 2:1 swr. The mechanicall minded may contrive ways of tuning such an tennas remotely for wide frequency coverage

The ⅜ inch copper tubing used for con structing my Double Hula was found to b reasonably adequate in mechanical strengt for several weeks. However there is som doubt to its survival in high winds or ice storms. More rugged material is suggested fo permanent use and especially for lower fre quency versions. . . . K2IC

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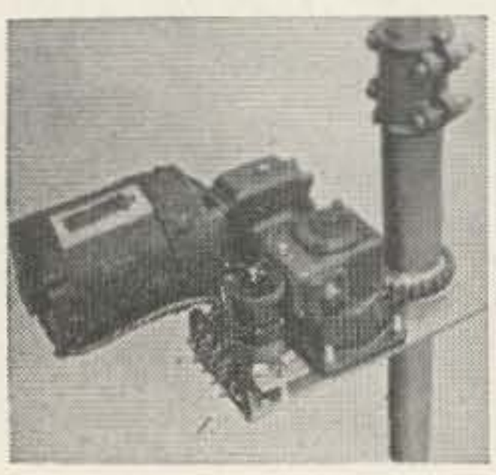

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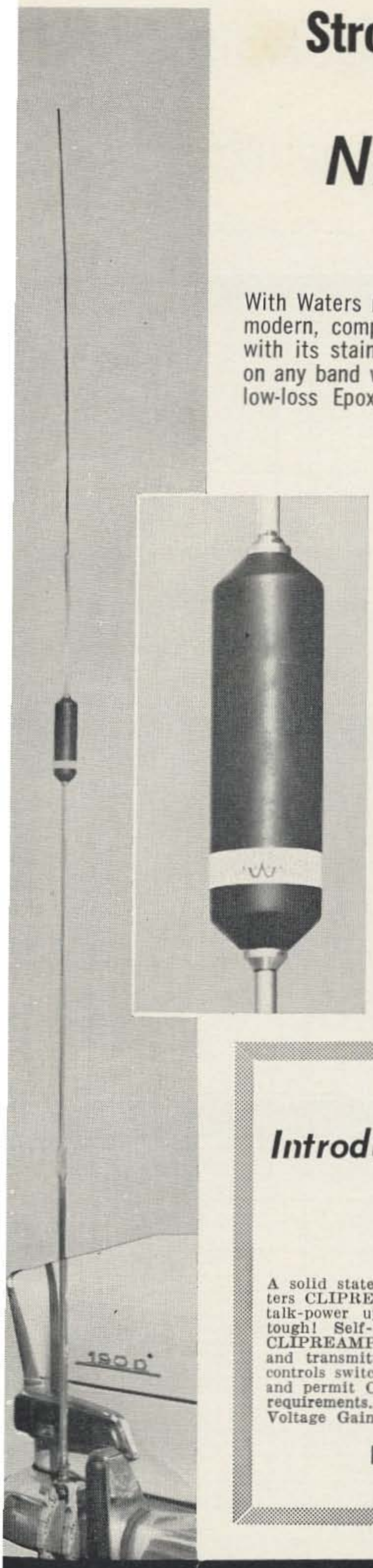

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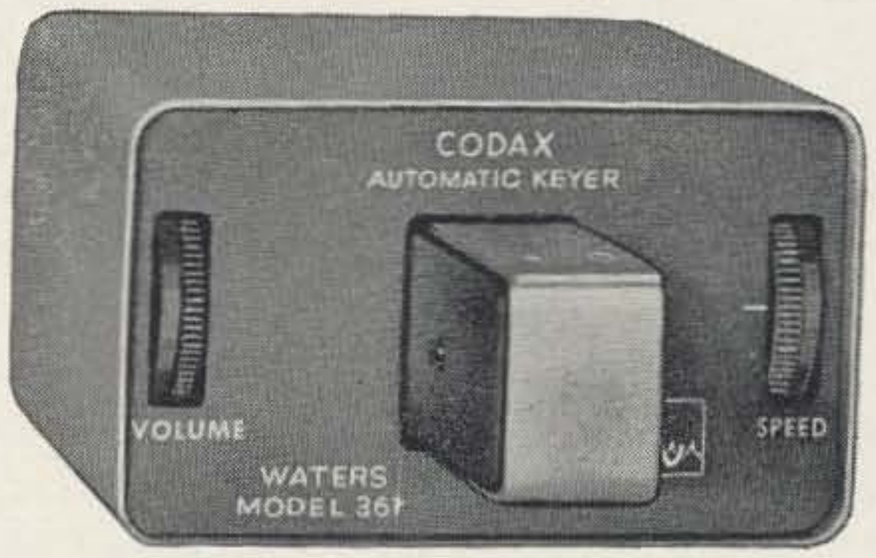

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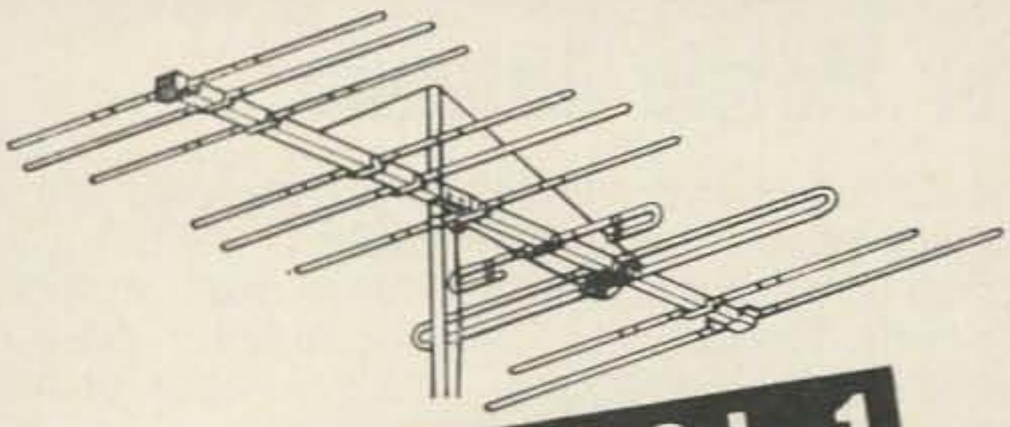

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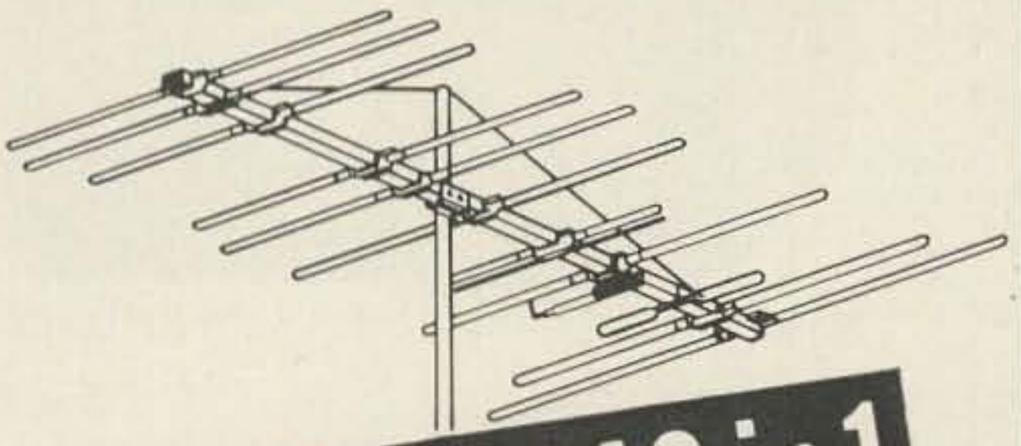

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MODEL A-62 GMC · 50 OHM

On 2 Meters:
Equivalent to 18 Elements
1-Gamma-Matched Dipole
1-3 Element Colinear Reflector
4-3 Element Colinear Directors

On 6 Meters:
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1-Reflector
2-Directors

Amateur Net **$34.50**
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Propagation Chart

April 1965

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7*	7	7	7	7	7	7	7	7*	7	14
ARGENTINA	14	14	7*	7	7	7#	14	14	21	21	21*	21
AUSTRALIA	14	14	7#	7#	7#	7	7	7	7	7#	14	14
CANAL ZONE	14	7*	7	7	7	7	14	14	14	21	21	21
ENGLAND	7	7	7	7	7	7#	14	14	14	14	14	14
HAWAII	14	14	7#	7	7	7	7	7*	14	14	14	14
INDIA	7	7#	7#	7#	7#	7#	14	14	14	14	14	7
JAPAN	14	7#	7#	7#	7#	7#	7	7	7	7#	14	14
MEXICO	14	7*	7	7	7	7	7*	14	14	14	14	14
PHILIPPINES	14	7#	7#	7#	7#	7#	7#	7	7	7	7#	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7*	7	7	7#	7#	14	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7#	14	14	14	14	14	7
WEST COAST	14	14	7	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	7	7*	14	14
ARGENTINA	21	14	14	7	7	7#	14	14	14*	21	21*	21
AUSTRALIA	14	14	14	7#	7#	7	7	7	7	7#	14	14
CANAL ZONE	14	14	7	7	7	7	14	14	14	21	21	21
ENGLAND	7	7	7	7	7	7#	14	14	14	14	14	14
HAWAII	14	14	14	14	7#	7	7	7	7#	14	14	14
INDIA	7	7#	7#	7#	7#	7#	7#	14	14	14	14	7
JAPAN	14	14	7#	7#	7#	7#	7	7	7	7#	14	14
MEXICO	14	7*	7	7	7	7	7	7*	14	14	14	14
PHILIPPINES	14	14	7#	7#	7#	7#	7#	7	7	7	7#	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7*	7	7	7#	7#	7#	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7#	14	14	14	14	7#

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	7*	14	14
ARGENTINA	21	14	14	7	7	7	7	7	14	14	21	21*
AUSTRALIA	21*	21*	21	14	14	14	7	7	7	7#	14	21
CANAL ZONE	21	14	7*	7	7	7	7	7	14	14	14*	21
ENGLAND	7	7	7	7	7	7	7#	7#	14	14	14	14
HAWAII	21*	21*	14	14	14	7	7	7	7	14	14	14
INDIA	14	14	14	7#	7#	7#	7#	7#	7*	14	14	14
JAPAN	14	14	14	14	7#	7#	7	7	7	7#	14	14
MEXICO	14	14	7	7	7	7	7	7*	7*	14	14	14
PHILIPPINES	14	14	14	14	7#	7#	7	7	7	7	7#	14
PUERTO RICO	14*	14	7	7	7	7	7	14	14	14	14	14*
SOUTH AFRICA	7*	7	7	7#	7#	7#	7#	14	14	14	14	14
U. S. S. R.	7#	7#	7	7	7	7	7	7#	14	14	7#	7#
EAST COAST	14	14	7	7	7	7	7	14	14	14	14	14

Very difficult circuit this hour.
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Good: 1, 2, 4-6, 13-17, 19-26, 30
Fair: 3, 7, 9, 10, 18, 27-29
Poor: 8, 11, 12
VHF Dx: 4, 13, 14, 30

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HF SSB Transceivers

Two years ago we ran our first sideband transceiver special section in 73. The reader response was so enthusiastic that I decided to repeat the section every year. Then, last year, with the amateur equipment sales at a ten year low due to the panic over the ARRL Executive Committee's submission of RM-499 to the FCC, there seemed to be little need for a buying guide. Things look much better this year. Quite promising. 16% of our readers told us that they intended to buy a sideband transceiver in the near future. That's a lot of transceivers.

	MODEL	DATE RELEASED	BASIC PRICE	FINAL TUBES	PEP INPUT	80 METERS	40 METERS	20 METERS	15 METERS	10 METERS	OTHER COVERAGE	SIDEBANDS
COLLINS	KWM-2	1960	1150.	2)6146A	175	3.8 - 4.0	7.0 - 7.4	14.0 - 14.4	21.0 - 21.6	28.5 - 28.7	14.8 - 15.0	both
DAVCO	DR-30 DT-20	10/64 4/65	700	8117	200	3.5 - 4.05	7.0 - 7.55	14.0 - 14.55	21.0 - 21.55	28.0 - 30.05	note *1	both
DRAKE	TR-3	6/63	550.	3)12JB7	300	3.5 - 4.1	7.0 - 7.6	13.9 - 14.5	21.0 - 21.6	28.0 - 29.7	- - - -	both
EICO	753	NA	k180. w300.	2)6DQ6B	180	3.49-4.07	6.97-7.33	13.89-14.41	- - - -	- - - -	- - - -	note *2
GALAXY	III	4/64	350.	2)6HF5	300	3.5 - 4.0	7.0 - 7.5	14.0 - 14.5	- - - -	- - - -	- - - -	both
GALAXY	V	7/64	470.	2)6HF5	300	3.5 - 4.0	7.0 - 7.5	14.0 - 14.5	21.0 - 21.5	28.0 - 29.0	28.5 - 29.5 acces.	both
HALLICRAFTERS	SR-150	11/62	650.	2)12DQ6B	150	3.5 - 4.0	7.0 - 7.5	14.0 - 14.5	21.0 - 21.5	28.0 - 30.0	- - - -	both
HALLICRAFTERS	SR-160	11/63	350	2)12DQ6B	150	3.5 - 4.0	7.0 - 7.5	14.0 - 14.5	- - - -	- - - -	- - - -	*2
HEATH	HW-12, 22, 32	5/63 7/63	kit: 120.	2)6GE5	200	3.8 - 4.0 HW-12	7.2 - 7.3 HW-22	14.2 -14.35 HW-32	- - - -	- - - -	- - - -	*2
NATIONAL	NCX-3	1/63	370.	2)6GJ5	200	3.48-4.02	6.98-7.31	13.88-14.42	- - - -	- - - -	- - - -	*2
NATIONAL	NCX-5	10/64	685.	2)6GJ5	200	3.5 - 4.0	7.0 - 7.3	14.0 - 14.5	21.0 - 21.5	500kc. seg. 1 xtal. incl.	- - - -	both
SBE	SB-34	12/64	395.	2)6GB5	135	3.775-4.025	7.05-7.30	14.1 -14.35	21.2 - 21.45	- - - -	- - - -	both
SWAN	350	7/64	395.	2)6HF5	400	3.5 - 4.0	7.0 - 7.5	13.85-14.35	21.0 - 21.5	28.5 - 29.0	- - - -	*2
SWAN	400	1964	395.	2)6HF5	400	3.4 - 4.0	7.0 - 7.4	14.0 - 14.4	21.0 - 21.6	28.0 - 29.8	WWV	both
TRANSCOM	SBT-3	3/65	300.	2)8042	165	3.78-4.01	7.18-7.32	14.13-14.36	- - - -	- - - -	- - - -	*2

*1 - Davco has 9.5 - 10.05 Mc WWV on receiver; 50 - 50.55 on both; 2 positions on both for 4 - 54 Mc.
*2 - LSB on 80 and 40; USB on 20; where 15 and 10 are included, mode is USB.

Those of you that have an April 1963 issue of 73 handy can whip it out and compare it with this one. It is very interesting to see what changes have come about during the past two years.

Starting at the top of the list I find that Collins is still selling their KWM-2, originally brought out in 1959. Six years production on one model is a recent record, isn't it? Next we find Davco. At long last, the ingenious Davco receiver is in production. The last I heard they had finally stopped pushing the state-of-the-art ahead in design and were shipping their first production units. The transmitter half of the combo is still a few months off, I believe. My impression of the receiver was that Jim Lovette K4BXO was not going to sell the thing until he had crammed something like the 75A4 into a 3 x 5 file box, transistorized.

The Drake TR-3, first announced in our transceiver section in 1963, has proven to be a real winner. It certainly had a lot to do with more and more five-band transceivers coming on the market. Bob named it after his Triumph TR-3. I think Bob must have a new Triumph because I understand they will soon announce a new model transceiver, the TR-4.

The Elmac ATR-4 never really materialized. One of the fellows that works here has one, but I haven't seen any others around.

The Hallicrafters SR-150, introduced in 1962, is still going strong and has been joined by the SR-160, a three-bander. The FPM-200 was a nice rig, but I guess it was too expensive for us hams.

The Heath transceivers are now history. Their first unveiling was in our transceiver survey.

National followed up their NCX-3, which had just barely come out in 1963, with the NCX-5 five-bander and a beaut of a linear. We'll run a special linear section later on for you.

Sideband Engineers is still going strong. Their SB-33 made quite a hit and their SB-34 seems to be doing it all over again.

Sonar. Hmmm. . . I think they have settled into selling commercial units and are not really trying to do much ham business. I haven't heard anything from them in the last two years.

Swan, the one who started this whole thing, is still giving everyone else in the field a hard run for the customers with their new Swan-350 with five bands and a $400 price tag.

Transceivers Inc. Their imitation Swan transceiver never actually made it into production.

Galaxy has a new one out, the V. You'll read more about that one in my review of it elsewhere in this issue. Their amazingly low price has not hurt their popularity one bit.

While three manufacturers have dropped out of the transceiver field, only two have recently entered it: Eico and Transcom.

Sideband is here . . . it has grown up. Our recent survey showed that 51% of 73's readers are on SSB. And 35.5% have a rig in their car. Got yours yet?

1st IF, Mc.	2nd IF, Mc.	HEIGHT	WIDTH	DEPTH	WEIGHT	VOX	100 Kc. CAL	S METER	SIDEBAND GENERATION	DELTA or OFFSET TUNING	DIAL CALIB, Kc.	MOUNTING BRACKET	AC SUPPLY	DC SUPPLY	TOTAL PRICE	
2.955-3.155	.455	7	14-3/4	14	18	yes	yes	yes	Collins mech.	acc.	1	120.	115. 168.	12V 200. 28V 470.	1468.	COLLINS
2.405-2.955	.455	4 each	7-1/8 each	DR-30: 6 DT-20: 9	9 11	yes	yes	yes	filter	*4	1		incl.	incl.	700.	DAVCO
9.0	- -	5-1/2	10-3/4	14-1/2	16	yes	yes	*3	separate xtal filt.	acc.	1	7.	80.	130.	786.	DRAKE
5.2	- -	5-1/2	14	11-1/4	25	yes	acc.	yes	xtal	± 10	NA	incl.	?	?	?	EICO
9.0	- -	6	10-1/4	11-1/4	13	$25	$20	yes	xtal	acc.	5	8.	80.	120.	477.	GALAXY
9.0	- -	6	10-1/4	11-1/4	13	$25	$20	yes	xtal	acc.	5	8.	80.	120.	598.	GALAXY
6.0 - 6.5	1.650	6-1/2	15	13	17-1/2	yes	yes	yes	xtal	RIT	1	40.	100.	110.	789.	HALLICRAFTERS
5.2	- -	6-1/2	13	11	13-1/2	acc.	acc.	yes	xtal	RIT	5	15.	100.	110.	500.	HALLICRAFTERS
2.305	- -	6-1/4	12-1/4	10	15	yes	$9	yes	xtal	no	2	incl.	40.	60.	180.	HEATH
5.2	- -	6-1/16	13-5/8	11-5/8	25	yes	acc.	yes	xtal	no	5	incl.	110.	120.	490.	NATIONAL
6.02	3.5	6-5/16	13-5/8	11-5/8	26	yes	acc.	yes	xtal	± 5	100cyc.	incl.	110.	120.	805.	NATIONAL
.455	3.225	5	11	10	18	acc.	acc.	yes	Collins mech.	± 1	5	12.50	incl.	incl.	408.	SBE
5.174	- -	5-1/2	13	11	17-1/2	$35	acc.	yes	xtal	no	5	20.	85.	130.	545.	SWAN
5.174	- -	5-1/2	13	11	17	acc.	yes	yes	xtal	no	2	20.	85.	130.	620.	SWAN
5.1	- -	4-3/8	11-3/8	8-3/4	10	PTT only	no	yes	xtal	no	5	3.50	140.	100.	403.	TRANSCOM

*3 - 2nd Drake meter indicates "S" units on receive and ALC on transmit.
*4 - Davco's separate receiver and transmitter allow either transceive or separate operation.

KWM-2

Collins Radio

Cedar Rapids, Iowa

Unmatched for versatility, dependability and mobility, the Collins KWM-2 maintains a reputation of outstanding performance in mobile and fixed station applications.

The KWM-2 power input is 175 watts PEP on SSB or 160 watts on CW. It transmits on voice or CW with a nominal output of 100 watts for complete coverage on 80 through 10 meters. Crystals are provided for all HF bands except 10 meters, where one crystal is supplied with provision for two additional crystals.

The transceiver is finished in light gray enamel with a simulated leather front panel to match the S/Line.

The first available amateur mobile SSB transceiver was in the Collins KWM series. The KWM-2 continues to lead the field with the following features: Filter type SSB generation providing unsurpassed performance on both transmit and receive.

Automatic load control which keeps the signal level adjusted to its rated PEP, resulting in an increase in average talk power.

Inverse rf feedback which improves linearity and reduces distortion products, giving the cleanest signal on the air.

Permeability-tuned Variable oscillator with linearity and stability providing the best frequency calibration available.

One kc division on all bands, eliminating frequency searching and allowing you to meet anyone on sked, on any band 80 through 10 meters.

Compactness and efficiency of the KWM-2 are achieved through Collins' advanced design of having all tuned circuits and several tubes function in the dual role of transmitting and receiving. The same oscillators, mechanical filter and rf amplifier serve both the transmitter and receiver. CW break-in and monitoring sidetone circuits are built in.

Easily accessible controls on the front panel of the KWM-2 include the OFF-ON-NB-CAL SWITCH, EXCITER TUNING, ZERO SET, PA TUNING, LOADING, MIC GAIN, BAND SWITCH, AF GAIN, RF GAIN, EMISSION and METER SWITCH.

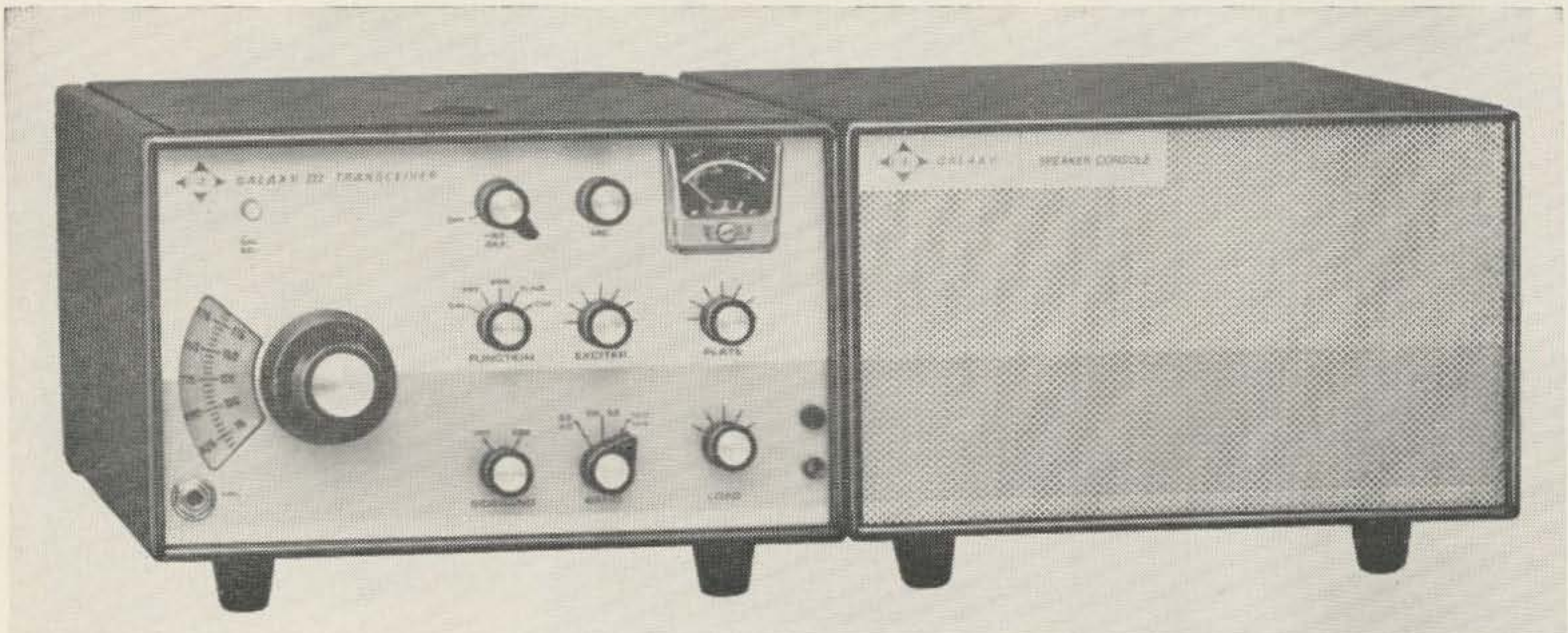
The KWM-2A is an extended frequency version of the KWM-2 for MARS (Military Affiliate Radio Service) and military applications. The KWM-2A has an additional crystal board permitting the operator to add 14 crystals to cover frequencies outside the amateur bands. The KWM-2A has a front panel switch and indicator, allowing instant switching between the two crystal boards.

TR-3

R. L. Drake Co.

Miamisburg, Ohio

The Drake TR-3 is designed to be a COMPLETE SSB transceiver. All ham frequencies, 80 through 10 meters are covered completely with all crystals furnished. Included also, are both sidebands, selectable as desired, dual metering of transmitter plate, and ALC and receiver S meter. The linear permeability tuned PTO covers 600 kc on each range. It is resetable to less than 1 kc if the dial is calibrated at the closest 100 kc. Amplified AGC is provided for receiving and amplified ALC is used to minimize flat-topping on SSB transmission. The 100 kc calibrator is built in. Vox, push to talk SSB, controlled carrier AM (260 watts PEP), and CW (260 watts PEP) functions are provided. 300 watts PEP input on SSB provides more than adequate output for driving the largest linear. This extra power was provided because a transceiver is often used as a complete station, mobile or portable, with antennas that are less efficient than in home stations. Accessories available are the AC-3 Power Supply for 120 or 240 volt, 50-60 cycle operation; the DC-3 Power Supply for 12 volt DC battery operation; the MMK-3 Mobile Mounting Kit; the MS-3 Speaker Assembly (provides space for AC-3 Power Supply); and the RV-3 separate PTO, speaker and power supply enclosure. The RV-3 provides independent transmitting and receiving frequency control for working DX and other independent uses.



III and V

The Galaxy III and V transceivers have many features. They are easily adapted to mobile operation because of their small size. They use the EZ Vue dial for minimum visual read-out error in mobile use. Their receivers are very sensitive: better than 0.5 μv for 10 db S/N. They have dual attack and release AVC to make the receiver virtually block proof. They have eight to ten db of ALC for increased power and minimum flat-topping and distortion. They have selectable upper and lower sidebands. They are manufactured under the strictest possible quality control. They have shifted carrier CW for best operation. Accessories available include a Deluxe console at $99.95 with 24 hour clock, SWR bridge, speaker, phone patch and a meter calibrated in SWR and VU. The Remote VFO is $59.95 gives full range coverage. The Standard Speaker Console is $19.95.

Galaxy Electronics

10 South 34th St.

Council Bluffs, Iowa

SR-150 and SR-160

The Hallicrafters Model SR-150 Transceiver is a precision-built, compact, high-performance radio equipment of advanced design. This transceiver utilizes 19 tubes and a dual conversion *if* to provide for the transmission and reception of single-sideband (SSB) and continuous wave (CW) signals on the 80, 40, 20, 15, and 10 meter bands. The SR-160 is a three band single conversion transceiver covering the 80, 40 and 20 meter bands. Both the SR-150 and SR-160 feature AALC for improved talk-power and third and fifth order distortion products down 30 db.

The versatility this equipment permits it to be operated as a fixed station or as a mobile equipment. A 117-volt, 50/60-cycle, AC power supply, complete with speaker is available for fixed-station use; a 12-volt DC power supply and a mobile mounting rack are available when the transceiver is to be used in a mobile configuration.

An advanced feature of these transceivers is the Receiver Incremental Tuning (RIT) control. This control enables the operator to unlock the receiver frequency and tune the receiver approximately two kc either side of the transmitter frequency. Flipping the RIT switch off automatically returns the equipment to the transceiver condition.

Hallicrafters Co.

5th and Kostner

Chicago, Ill.

HW-12, 22, 32

Heath Company

Benton Harbor, Mich.

The three Heath single band SSB transceivers are neatly styled units providing complete transceiving facilities suitable for mobile or fixed operation. Features include a deluxe fourteen tube superheterodyne circuit for receive that provides a sensitivity of 1 microvolt and selectivity of 2.7 kc at 6 db and 6.0 kc at 50 db. Drift is less than 200 c/hour after warm up. Transmitter final input is 200 watts PEP. The VFO operates on 1.5 to 1.8 mc. PTT and VOX are built in, and provision for a linear amplifier is provided. An optional 100 kc crystal calibrator is available.

Assembly is easy with over 90% of the components mounting on a heavy circuit board. A pre-cut, cabled wiring harness and easy-to-follow instructions further simplify assembly. Alignment is easy as all critical stages are pretuned. The gimbel mounting bracket is included.

NCX-3, NCX-5

The NCX-5 is National's 5 band SSB transceiver. It has digital counter tuning readout accurate to 1 kc with dial calibration to 100 cycles. The NCX-5 uses a solid state VFO with *no* warm-up drift; it is virtually unaffected by large variations in input voltage. The upper and lower sidebands are switch selectable with no retuning. National's new 6.0218 mc 8 pole crystal lattice filter has a shape factor of 1.7:1 and a 6 db bandwidth of 2.8 kc. The Transceive Vernier control allows ±5 kc receiver separation from the transmit frequency. 10 db of ALC minimizes flat-topping. Among other meatures are two receiver rf stages to provide 0.5 μv sensitivity for 10 db S/N ratio; separate AM detector; VFO input for optional VFO console; choice of built-in VOX, PTT or MOX (manual control); and break-in grid block CW.

The NCX-3 Triband SS transceiver provides complete coverage of the 80, 40 and 20 meter phone and CW bands, VOX or PTT, grid block break-in CW, product detector for CW/SSB and triode detector for AM and geared planetary tuning dial. The handsome front panel is anodized for maximum protection against wear.

National Radio Company

Melrose, Mass.

SB-34

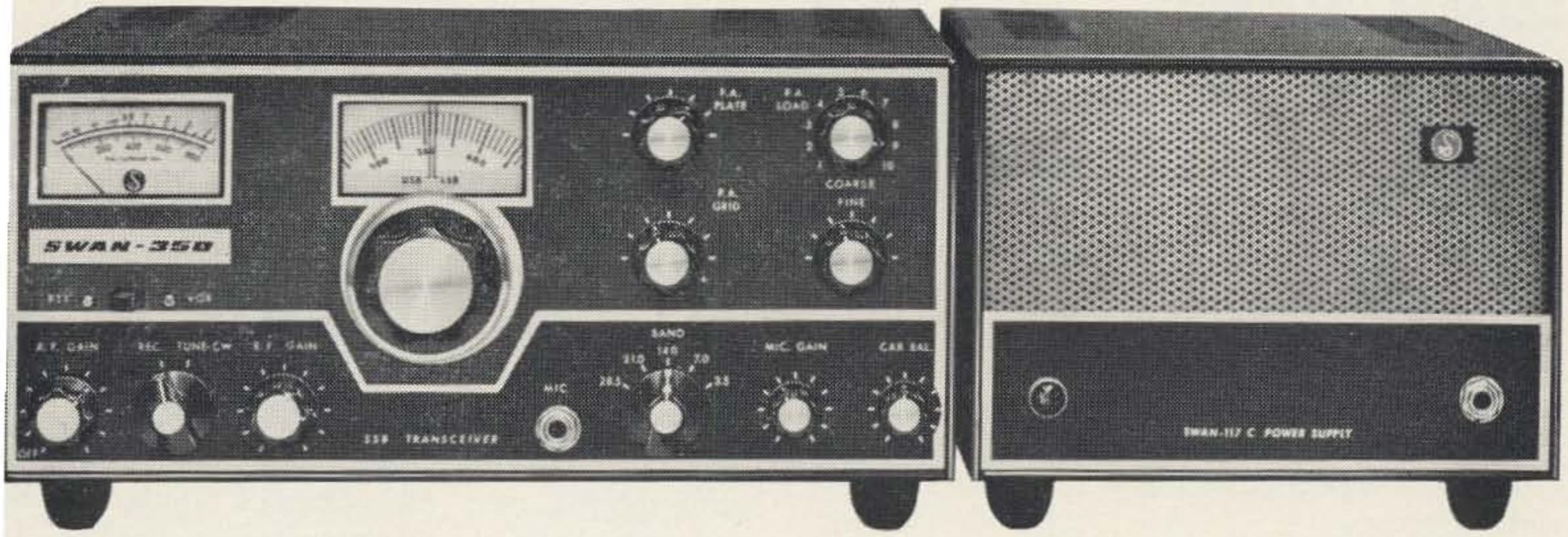
Sideband Engineers

317 Roebling Rd.

S. San Francisco, Calif.

The SB-34 is a four band SSB transceiver using 23 transistors, 18 diodes, 1 varactor, 1 zener diode and three tubes. Using transistors so extensively results in lower current drain, cooler operation, longer life and small size. Performance is equivalent to or better than comparable tube-type transceivers. For example, receiver sensitivity is 1 μv for 10 db S/N. 2.1 kc selectivity is provided by the Collins mechanical filter.

The SB-34 uses bilateral amplifiers and mixers throughout, on both transmit and receive. They operate by controlling the direction of amplification. This reduces circuit complexity, reduces the number of materials required, simplifies adjustments and eliminates the need for transmit-receive relays. Tuneup and operation of the SB-34 is simple; a unique permeability tuning slug mechanism eliminates separate coil sets for each band. An ingenious Geneva movement combines bandswitch and exciter tuning functions in a single knob. The loudspeaker and both ac and 12 v dc power supplies are built in. Drift is very low: less than 100 cycles in any 30 minute period under any normal ambient condition.



350 and 400

Swan Electronics

Oceanside, Cal.

Swan Electronics is currently marketing two 5 band transceivers. Each is rated conservatively at 400 Watts PEP input. These models, the 350 and the 400, are outgrowths of the original SSB single band transceivers and the very popular model 240 tribander.

Swan's outstanding reputation for high performance quality and dependability at a reasonable cost has been built over a relatively short period and these two additions to the line will undoubtedly enhance this reputation.

The 400 is the deluxe model in the Swan line. An external VFO with no built-in heat source provides exceptional stability and calibration. Warm-up drift is negligible and the unit is rockstable after the first few minutes. This unit is readily adaptable for use on Mars frequencies or commercial frequencies without loss of ham bands.

The standard model 350 transceiver includes all necessary features for either fixed or mobile operation on all bands and permits inclusion of non-essential but nice "features" at nominal kit cost. It features the same high quality and reliability of the 400 and other Swan transceivers, and it is priced reasonably.

IoAR News

Something new has been added for IOAR membership! A new low membership fee has been announced as yearly dues of the IOAR. There's something tangible in it for you, too. Here's how it works–for $7.00, now you can have an active part in supporting the IOAR as a full member and receive 73 Magazine, too. There's no distinction as to membership levels dependent upon the class of your amateur radio license.

How about those that are already IOAR members and receive the magazine and want to get in on the combined arrangement? Easy! Send in your $7.00 for IOAR and 73, and your membership will be extended through your current 73 subscription and then will run concurrent with the added 12 issues of the magazine. (No adjustments either way, please.)

Now–how about the fellow who is a current subscriber to 73 only? Send in your $7.00. Your IOAR membership will start immediately and will remain through your present subscription until expired and then will automatically continue for the additional 12 issues of 73 until the concurrent expiration of membership and 73. All conditions soon come into adjustment. We call it "togetherness." Simple, isn't it?

O. K. fellows, now let's build, Build, BUILD MEMBERSHIP! (Later, arrangements are anticipated to be worked out on a club affiliated membership basis.) Let's get that treasury swelling so we can allocate emergency funds to cover amateur radio contingencies as they occur. IOAR wants to be ready to assist where necessary.

If you didn't already recognize it–it is a fact that 73 is the official organ of the IOAR. Not the entire magazine, but those number of pages carrying the IOAR News and other features pertinent to IOAR.

The constitution and by-laws are forthcoming. They are about ready to be released through our own official news media (IOAR News that is) in 73 Magazine. All IOAR members will have a chance to ratify the rules. Unlike other organizations of similar intent, IOAR will be democratic. Let us all keep it that way. It may take a little longer, but members will have their say.

The IOAR is not and will not become a publishing house. Its prime interest will continue to be devoted to the amateur radio fraternity. 73 Magazine is quite capable of disseminating all official IOAR matters with its national and international wide range of distribution reaching IOAR members and nonmembers alike all over the world. In this connection, it is sound business management to captivate the largest field of absorption (73 is widespread and influential) on matters of the IOAR to all interested amateur licensees of all classes whether they are members or not.

Get set soon for a voluminous and complex FCC proposal for rule making affecting, to some degree, most all classes of amateur radio licensees. Some of you won't like it. It is anticipated that a sizable minority group will not be affected (again).

Looking on all sides of the problems and having had measured the RM-499 official file of dissenters, the proposal probably won't be identical to this mad, mad, mad approach. But don't be too self assured–read the fine print carefully–rumor–strictly rumor has it that the old guard has rallied again. Don't rule out the possibility that the W4RLS Foy Guinn petition may have been studied with all of its thousands of Joiners in Petition. The FCC certainly has had enough elapsed time to ponder and come up with something really good (we hope) as opposed to the one organization's approach over a year ago.

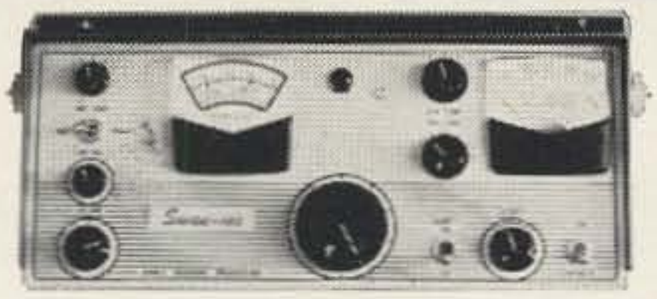
A lot of you remember FCC's Docket 9295 of the 1949 era. The ARRL, not content with the commission's "Basis and Purpose" and a truly realistic incentive licensing plan, chose to hack away for the protection of the old Class A to avoid their losing operating privileges because the FCC proposed placing them into the General Class bracket (I wonder what it will be this time). Well–that was a long time ago–the battle won but the war was lost–could the ARRL have been remiss?

If you support or disagree with the "new approach" (The FCC proposal), carefully observe the deadline date for filing and get those good reasons of yours off to the FCC in an ORIGINAL plus fourteen (14) additional copies substantiating your comments pro or con.

Yes–the IOAR has stamps. They are a brilliant orange-red and self-adhesive. Perhaps you have seen them. Request your stamps today with your membership application–JOIN IOAR–BOOST IOAR–PUSH IOAR.

E. M. Schaad WA4PDX/W9A1Y
Director

IT'S THE SAME LITTLE OLD BOX



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A Versatile Code Monitor

with bonus features—

As every CW operator knows, a code monitor independent of the station receiver helps in clean sending and in maintaining the receiver tuned to that always elusive signal. During my ten years on CW, I have tried every published circuit on monitors without finding one to completely satisfy me. Most required stealing power from the receiver, practically all were dependent on some connection to the transmitter and others utilized plug-in coils to cover more than one band. I finally decided to build my own and the result is a transistorized self powered monitor that works on all bands without tuned RF circuits and needs no attachments or proximity to the transmitter. It can be used as a field strength meter, code practice oscillator, in the home, the car or in the field. The cost of all new components except the meter runs well under ten dollars.

The Circuit

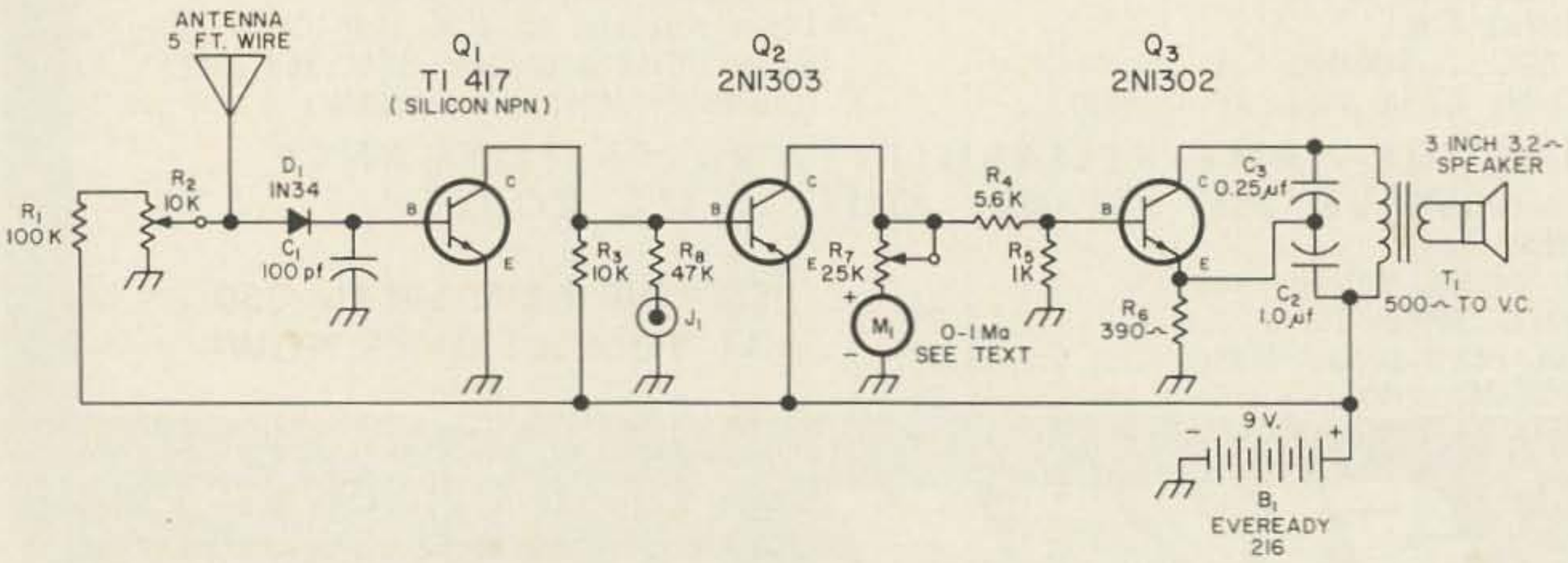
The complete schematic is shown in Fig. 1. The heart of the circuit is the complementary high gain DC amplifier made up of Q_1 and Q_2, which precedes the Colpitts oscillator Q_3. Potentiometer R_2 sets the operating point of the DC amplifier to a threshold condition with diode D_1, Q_1 and Q_2 barely conducting. Under these conditions the collector of Q_2 rests at near ground potential. The oscillator transistor Q_3 receives its base bias from a tap on the Q_2 collector load made up of R_4 and R_5. With the collector of Q_2 sitting on ground, the oscillator is biased off. Interception of RF energy by the five foot length of wire used as antenna, causes additional current to flow through D_1 and the base of Q_1. This current is amplified by Q_1 and Q_2, resulting in saturation of Q_2, which now has its collector at near supply voltage. Q_3 now is properly biased and oscillates. With the values shown the frequency is 500 cycles, a very clean sine wave, and the volume is sufficient to annoy the XYL.

A meter in series with potentiometer R_6, placed between the collector of Q_2 and ground, adds a field strength function to the unit. Since the meter is at the output of the DC amplifier a rather inexpensive movement can be used. I use a 0-1 ma meter, but anything up to 10 ma can be used.

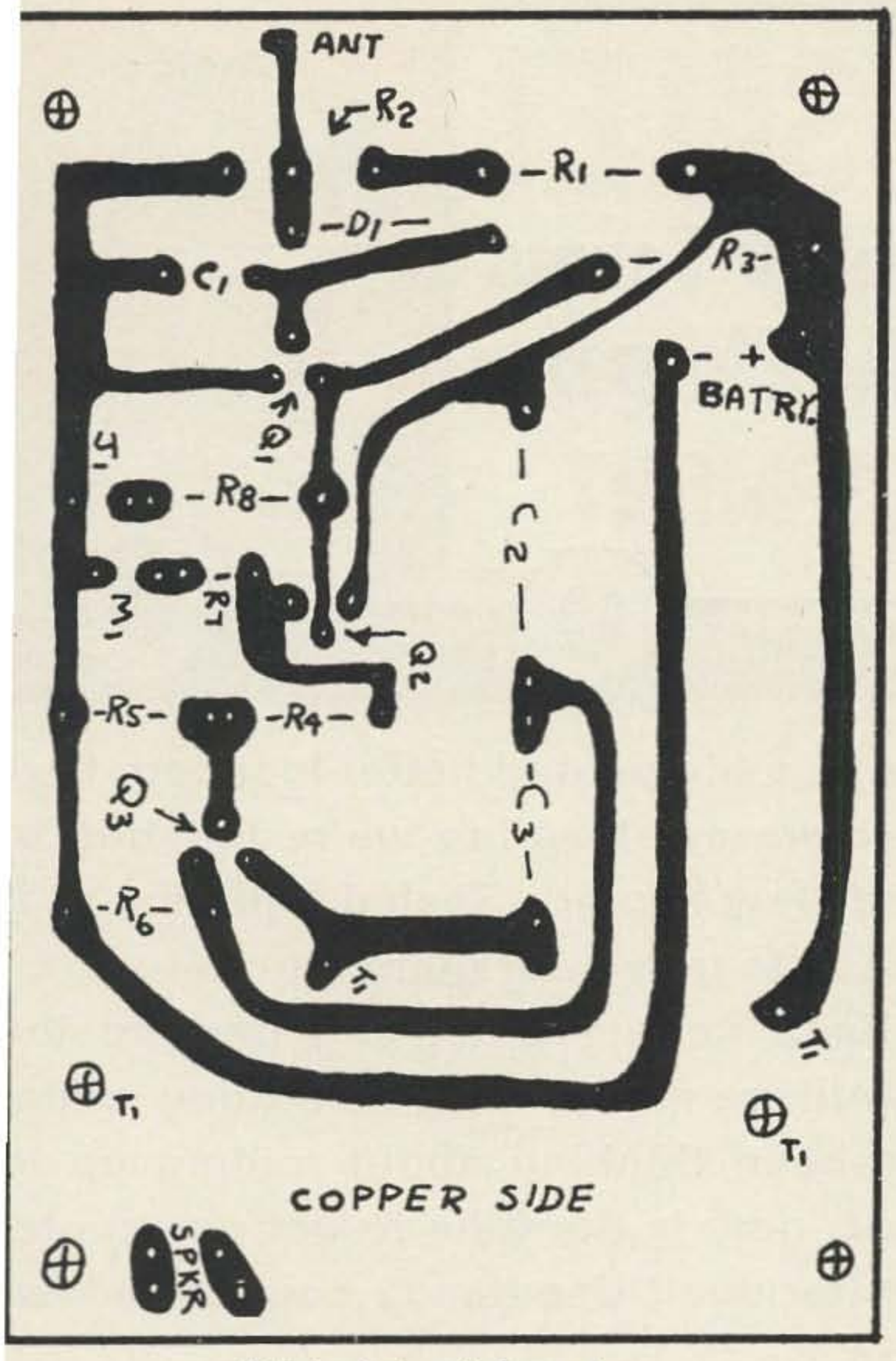
A 9-volt transistor battery is used to power the unit. No ON-OFF switch is used. With the oscillator off, the drain on the battery is only 1/10 ma., and the battery should last its shelf life.

Construction

A home made printed circuit board is used to mount all components except the two potentiometers, jack, meter, and speaker which mount on the face of $5'' \times 5'' \times 7''$ box. The printed circuit pattern is shown to size in Fig. 2. Lacking a printed circuit board, any con-



Versatile Code Monitor



Printed circuit layout.

construction method can be used. Since no RF tuned circuits are used, no particular care need be exercized in layout of components. Make sure that the right output tap is used for the speaker impedance you are using.

Operation

To use the monitor, advance pot R_2 until some broadcast band chatter is heard on the speaker, back off a hair, and you are ready to monitor your transmissions. With my 100 watt transmitter in tune position, positive, chirpless keying is obtained on all bands. If you like QRP, use a longer hank of wire as antenna.

To use the field strength meter, advance pot R_2 until the oscillator is on. Adjust pot R_6 to bring the meter full scale. Leave R_6 alone and use R_2 as the only sensitivity control. Keep the meter reading below 7/10 of full scale. By carefully adjusting R_2, it is possible to obtain audible changes from the oscillator as the transmitter is tuned for maximum output. This feature may be used by the blind amateur as a means of tuning the transmitter.

After you go QRT, plug in a key in jack J_1 and let the harmonics practice for that long awaited novice license.

. . . W8GXU

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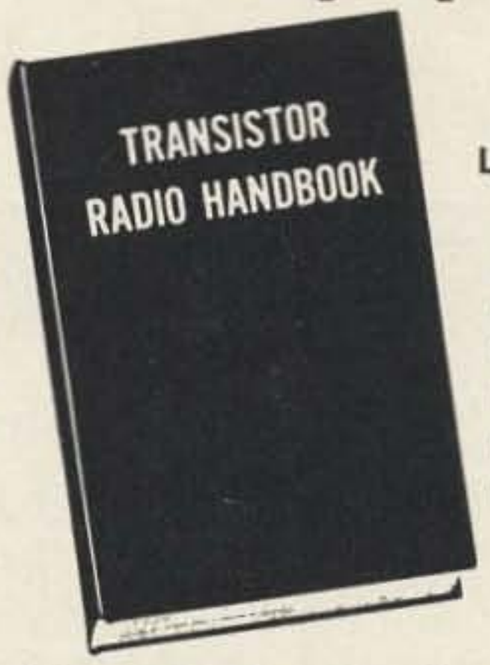

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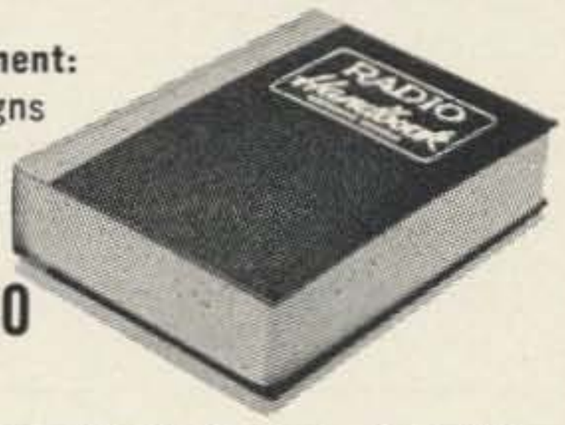

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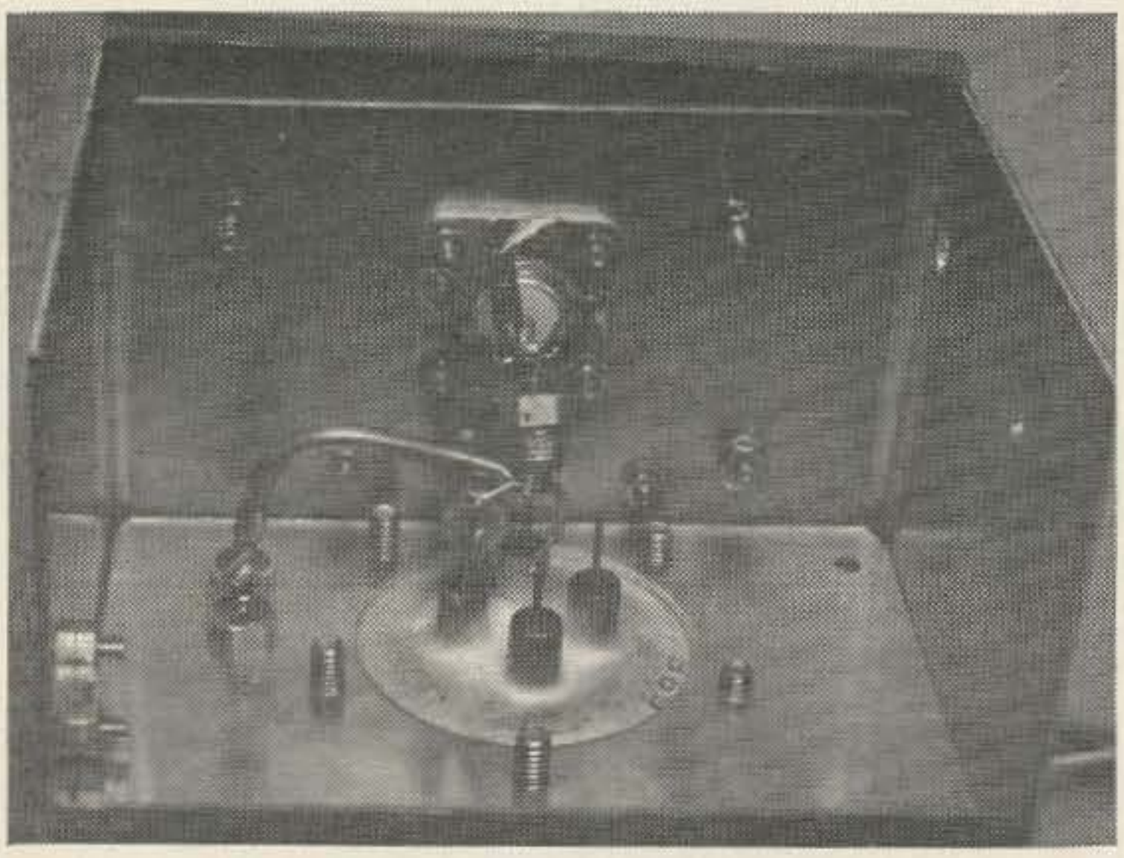
Calibrated Noise Generator for 432



RF Circuitry.

Now that the lid is off the 420-450 mc band as far as power restriction goes, many hams are reaching for the moon-bounce mode on this band, where available transmitting tubes can be used. Groups of 4X150's, 4X250's, 2C39's and such tubes can actually be made to work at 432 mc at the kilowatt input level. Also, the receiver problem isn't quite as hectic as it is at 1296 mc; nuvistors or WE 416B tubes will perform fairly well. Even paramps can be constructed more easily at 432 mc than at 1296 mc, because the pumping source can be of a lower frequency. It sounds as if it is going to be easy to get on, doesn't it, but don't anticipate the world-wide lunar QRM yet—there are some things to be done.

The hams who are going to be successful at 432 moonbounce, are the hams who equip themselves to make *measurements*. The report, "It didn't seem to work" at the termination of a long, inspired ham construction project, tells one nothing. Since there are many pitfalls, the guy who can instead say: "it doesn't have a low enough sputter ratio" is the one who will persist and, after fixing the trouble, be on "states-worked" page.

As pointed out in previous articles—the temperature-limited noise diode is the best tool for measuring the sensitivity of one's receiver. The measurement made with this device is "noise-figure" or "noise-factor" and this is the magic number by which you can compare your VHF or UHF receiver with Joe's down the street, or Sam's in Massachusetts. These measurements will be comparable between any two receivers because bandwidth, type of detector, and other miscellaneous features (different for each receiver) do not affect the measurement, if it's carefully made (that is, if one's measurement of 3 db power increase, when the diode is turned on, is true).

Past amateur articles on noise-diodes and their use in noise-factor measurement have

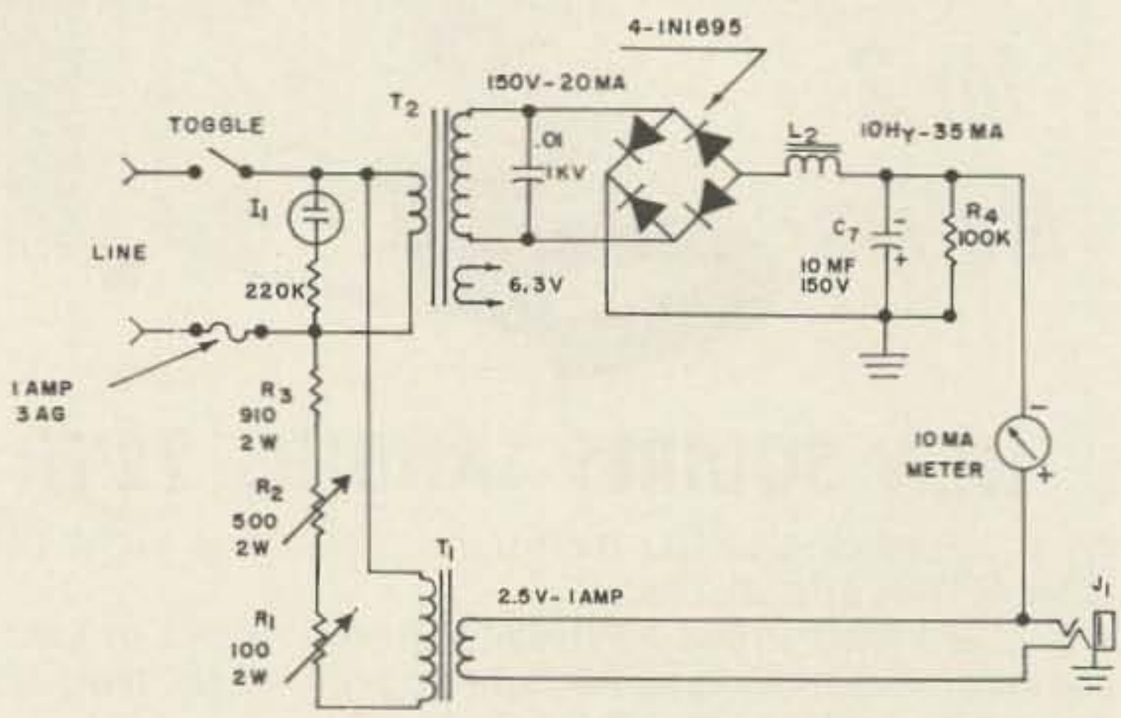


Fig. 1. Power supply.

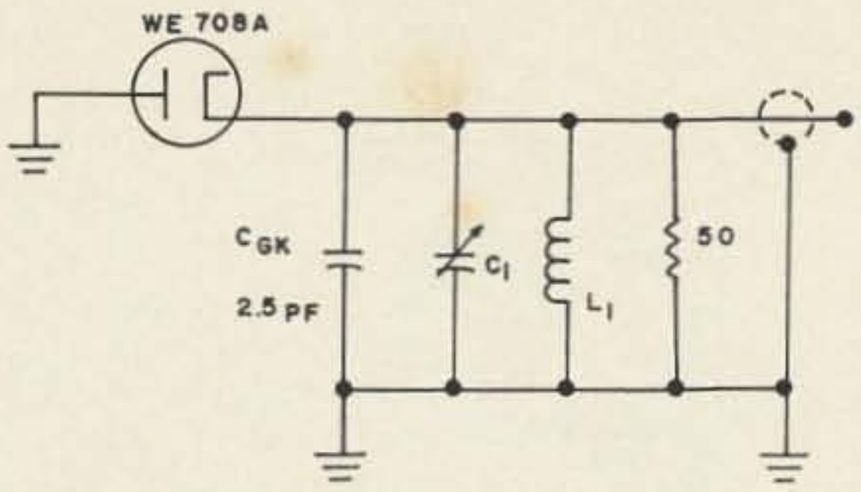


Fig. 2. Basic noise generator circuit.

only shown how to construct units for up to about 200 mc. The noise generators described previously, for amateur use, have used the 5722, the diode wired 24G (3C24), or the diode wired 801A, as their tungsten-filament diodes. The 15E and 01A have also been used occasionally as diode-wired triodes, too. Commercial UHF noise generators use a variety of tungsten-filament tubes, all of which are a bit expensive for most hams. If you can lay your hands on one of these tubes, used or otherwise surplus, by all means employ it in your noise generator. Table I is a list of such gems.

Philco:	L1262A
RCA:	R6212
Bendix:	6144
Marconi:	CV2171

Table I

The tube I used is a triode, a Western Electric 708A, originally designed for grounded-grid UHF amplifier service. The grid and filament are used as the diode elements, ignoring the plate altogether; the plate, if used, could only increase transit time and shunt capacity. The tube is used, as it was intended to be used, with the metal shell (grid) grounded. The 50 Ω load is connected in the filament cricuit; the filament power is fed in by means of a concentric inductor, which also tunes out the stray capacity of the tube.

C_1, a small "tweaker," adds in a tiny additional capacity to make adjustment to 432 mc easier; it makes tuning to anywhere in the 420 to 450 mc band possible. L_1 is constructed of a 1¾″ length of ⅛″ copper tubing and has a piece of No. 20 teflon insulated wire inside it. The use of teflon insulated wire is only necessary because teflon will withstand the heat of soldering.

The effective circuit, then, is as in Figure 2.

At 432 mc, if $Cgk + C_1 = 3$ mmfd, then L must be 0.04 μh to be parallel resonant. The reactance of either $Cgk + C_1$ or L_1 is about 100 Ω, so the system has a Q of ½, and hence will be rather broad in its noise output spectrum—just as we want it to be.

The WE 708A tube was recently available from a Los Angeles surplus emporium at the price of 39 cents each or ten for a dollar. We bought a buck's worth, figuring some would be NG, but all were perfect and saturated well. One was lost in initial test, when we applied too much filament voltage; it was subsequently hack-sawed open to find out the details of its construction and to confirm connections. The details learned are presented in Figure 3 along with its saturation curve.

The filament is a single, fine, straight, tungsten wire through the grid helix. The grid helix is perhaps 1/16″ diameter and is welded every turn to the shell. All this adds up to: good cylindrical diode configuration, close cathode-grid spacing to cut down transit time, and low grid to case inductance. In short, we have a nearly ideal noise diode for a dime a piece.

Construction details: The rf section of the generator is constructed on an aluminum plate bent into an L, the WE 708A protrudes through a 1⅝″ round hole to expose its filament pins next to where the UG58A/U connector is mounted on the other side of the L. The WE 708A is held in place by five 8-32 binding-head screws that are tapped into the plate. The UG58A/U has four 200Ω, ½ w resistors soldered to it each at 90° to its neighbors to form a less inductive load, approximating a resistive sheet. These resistors are

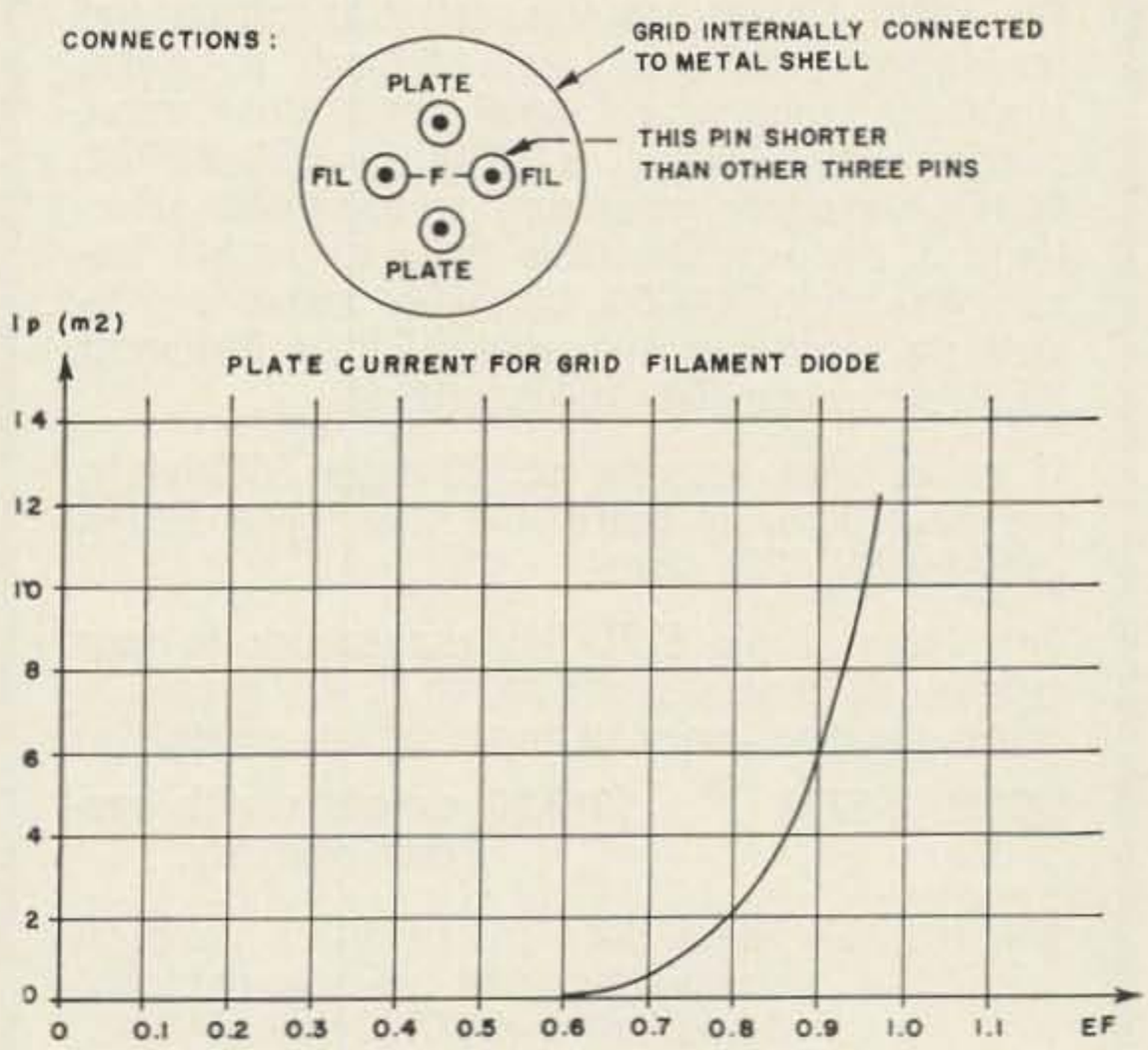


FIG. 3

Fig. 3. Connections of 708A and graph of relationship between "plate" current and filament voltage.

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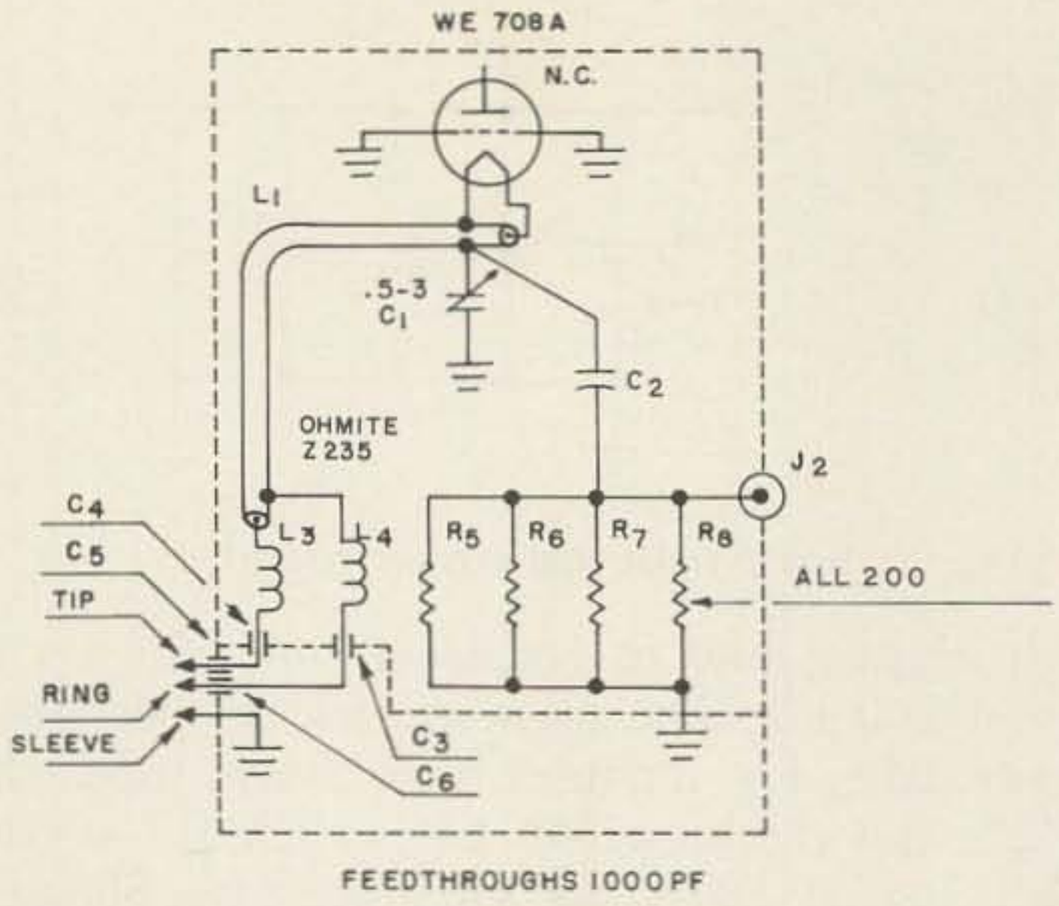

Fig. 4. Circuit of diode noise generator.

soldered to the UG58/U before it is mounted to the aluminum sheet to make soldering easier (less heat required). Then L_1 is formed and soldered from the WE 708A filament pin to C_3. The center filament lead of L_1 is fed through and soldered to the other filament pin and to C_4. C_2 is then soldered in; be sure this is the type called for or a similar low inductance stand-off ceramic. The rest is straight forward. Diode and power supply were each built in an LMB 141 box chassis. The details of wiring the diode circuitry are shown in Fig. 4.

A word about R_1 (the "fine" adjust) is worthwhile. Make *sure* this one is a 2w type A.B. (ohmite) molded carbon pot, if not both R_1 and R_2. This will make smooth diode-plate current adjustment easy; a wire wound pot will cause the plate current to vary in steps because of the effect of the pot's sliding contact sequencially contacting each wire (the same applies if you use a Variac).

To align on 432 mc, C_2 is temporarily removed and a UHF grid dip meter coupled to L_1, loosely. C_1 is adjusted for a dip at 432 mc. Then C_2 is reinstalled, and we should be ready for receiver checks.

The above noise generator was compared with a Hewlett Packard 343A noise diode using my own 432 mc converter as the "to be measured" device. The results showed less than 0.5 db difference.

The author wishes to thank Gene Howell, W4RLU, for his photography of the unit.

. . . W6GXN

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1. Jones, F. "V.H.F. For the Radio Amateur," C.Q. Technical Series, p. 178-184.
2. Goodman, B. "How Sensitive Is Your Receiver," Q.S.T., Sept. 1947, p. 13.
3. Geisler, D. T. "Reviewing The Radio Classics," C.Q., June 1963., p. 40.

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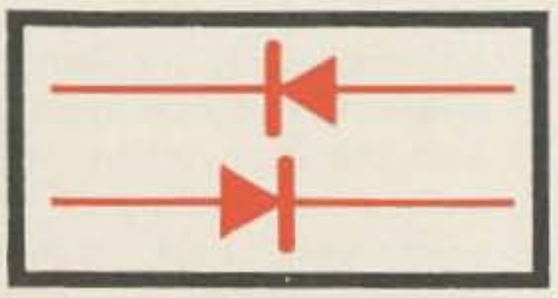

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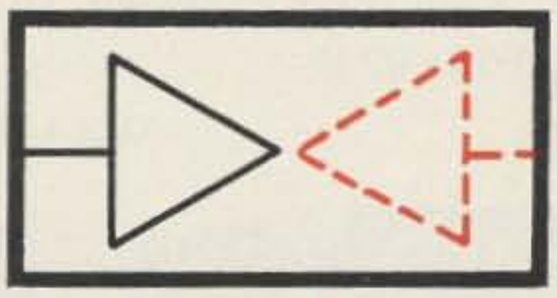

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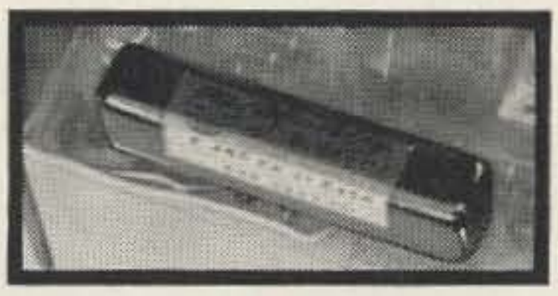

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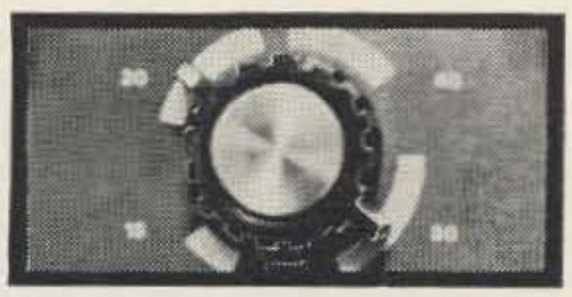

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The KWS-1 as an SSB Exciter for VHF Heterodyne Converters

Judging by the number of SSB signals now coming up on the VHF frequencies, this is rapidly becoming one of the most popular modes of operation. SSB can do on VHF and UHF what it has done on the lower frequencies: provide more reliable extended range communications. Most transmitting converters marketed are designed for low power exciters, with the higher power ranges requiring attenuation. The KWS-1 is still at the top of the art for high quality SSB, but the high cost of this transmitter has discouraged most experimenters from modifying it.

It is possible to extract the required low level SSB from the KWS-1 on the band of your choice without drilling any holes or soldering internal connections. The attachment may be removed at any time without signs of ever having been present!

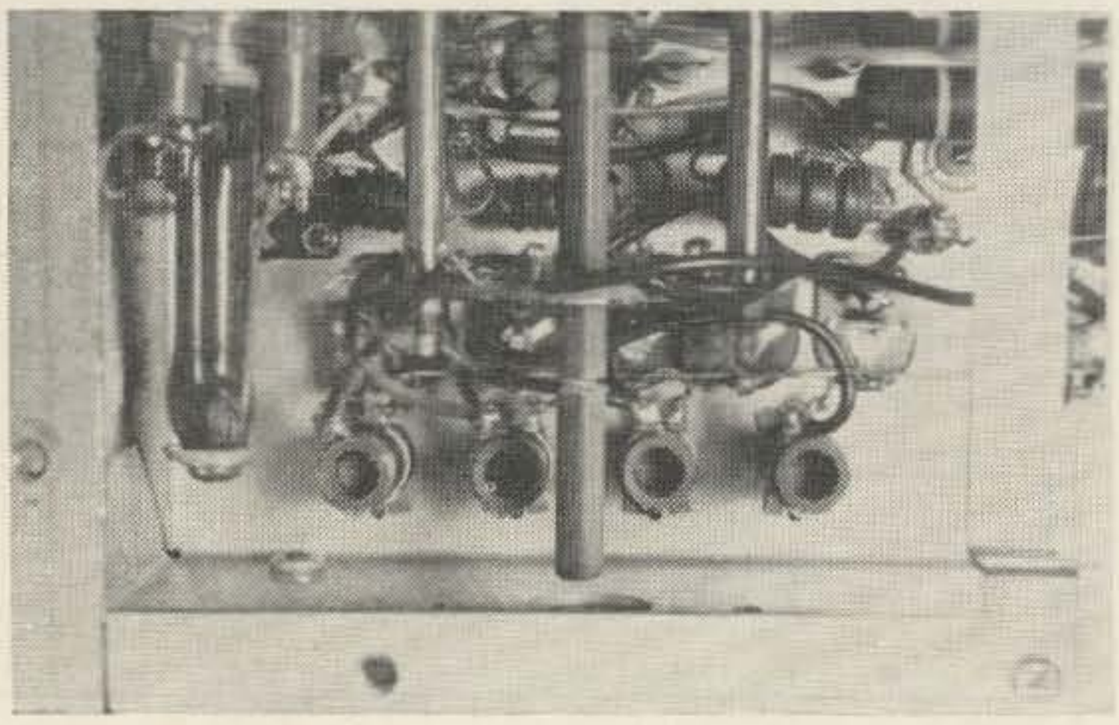
The left rear of the rf cabinet has a large plug button which can be removed. It was placed there should it be necessary to remove the band change switch shaft. Note the "before" photograph where the shaft extends above and between the plate coils of the parallel 6CL6's which are the rf drivers to the final 4CX250B's. This photograph was taken with the bottom pan of the chassis removed. To make room for the coax jack the shaft must be shortened. The shaft is of a non-brittle laminated fibre and saws easily with a hack saw blade. Not much need be removed, about 1½ inches will do. Removing this piece will not interfere with the original purpose of the hole behind it.

The "after" photograph shows the shaft end removed and the coax plug mounted in the shaft removal hole. Either the UG-1094/U or the UG-625/U single hole mount female sockets fit the original hole perfectly. The mating plug for this is the commonly used BNC connector.

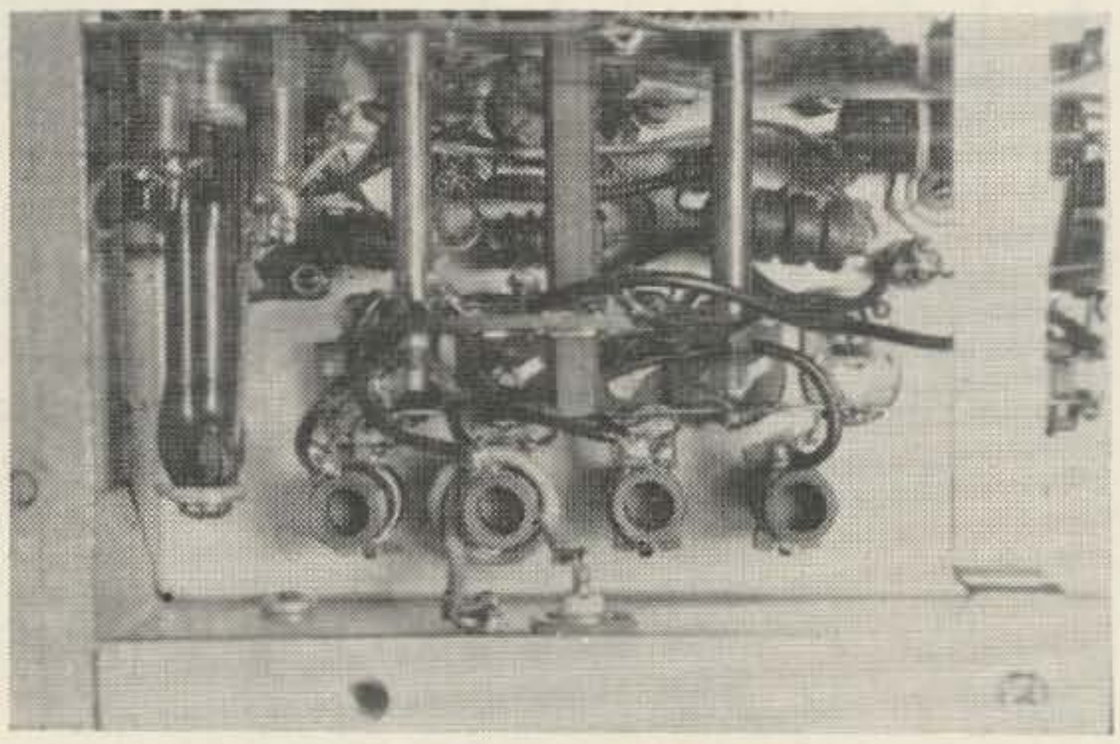
A two turn link is wound around the coil of your choice as shown in the photograph. Some converters call for a 14 mc input, and others for 28 mc. It must be remembered that the direction of wind is the same as the original coil, and that it is placed adjacent to the cold side of the coil which is nearest the chassis pan. The "coldest" end of the link goes to a lug placed under the coax socket nut for a ground and the hot side to the inner conductor of the coax socket.

No retuning of the 6CL6 coils was found necessary, and when this exciter function is desired, the KWS-1 high voltage plate switch is turned off, and 4CX250B filament fuse is removed. When you return to normal HF operation, simply return the fuse and remove the coax plug. That is all there is to it.

. . . W4API



KWS-1 before modification.



KWS-1 after modification.

KWM-1 on LSB

One of the finest values in used equipment on the market today is the KWM-1 selling for about $300 to $350. It is, without a doubt, one of the most rugged, sensitive transceivers ever built. It has a couple of faults, it covers only 10-15 and 20 meter bands, but the sun spot cycle will be bringing back the 10 and 15 meter bands in a couple of years. The other is its inability to operate on lower side-band when the QRM gets tough, this can be easily corrected.

With apologies to Louis Weber, K6GHU, (P. 60 December 1963, 73 MAG), and his excellent article on the KWM-1, I for one always hesitate to actually modify a mfrs. outfit, but Mr. Weber did give me an excellent idea on how to work my KWM-1 on lower side-band without any modifications. First remove the B.F.O. XTAL (the one up front near the P.T.O.) and check its frequency. Next, subtract 455kc from the crystal frequency. Take this remainder from 455kc and you have the frequency of the XTAL you need to get on lower side-band.

As Mr. Weber pointed out, the crystal must be calibrated to .01% as measured into 32 mmfd input capacity. To go on lower side-band, all you have to do is change crystals. I took a piece of Polystyrene rod about 3" long and ½ inch in diameter and notched each end so the XTAL's just fit into the notches.

With a couple of turns of "scotch" tape to hold the XTAL's in place in their notches, and a small cork on the top XTAL to hold it firmly in place, when the lid is lowered, it's not much of an effort to lift the lid—remove the cork, swap the rod end for end to insert the other crystal, put the cork back on the opposite crystal and close the lid. The dial will tune off frequency about 3kc from where it normally tunes. I obtained my crystal from R. E. Woods Electronics, 2164 North Parkway Drive, El Monte, California.

. . . W3AQY

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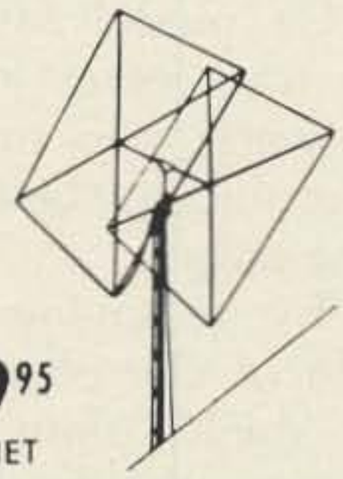

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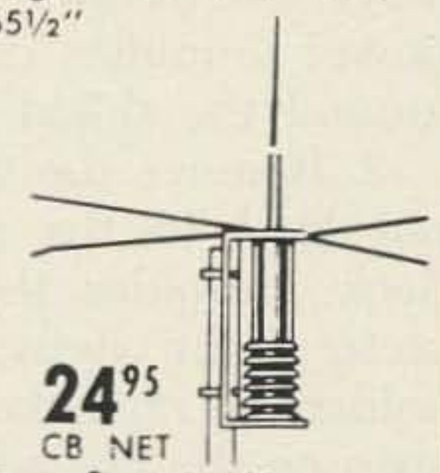

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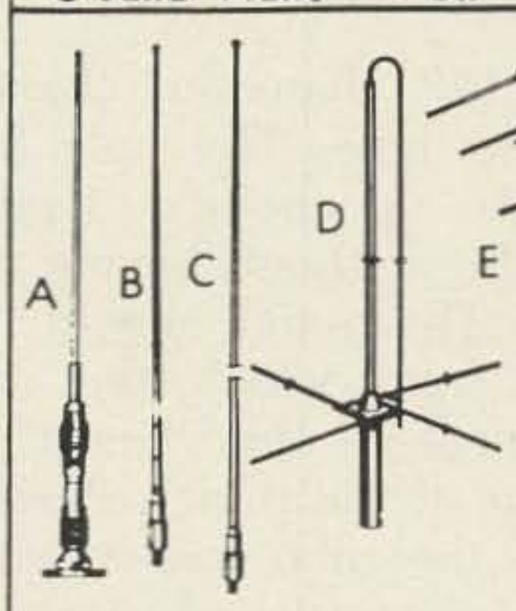

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200 watts with a Swan 240

The Swan Engineering Co. model 240 is a 3 band (3.8-7.2-14.2 mc) transceiver capable of a SSB output of 100 watts pep or more. Adding another 6DQ5 or replacing the 6DQ5's with 6HF5's can double the output.

1. Remove the cover by removing the 3 metal screws on each side of the chassis; remove the screws on the shield plate of the power amplifier cage; remove the back wrap around the shield across the rear of the unit.

2. Remove the 6DQ5 tube and unsolder the red lead to the small capacitor on the PA deck; unsolder the brown-white lead to the meter light above the 0-400 ma meter; unsolder the rf choke that runs from the terminal strip on the chassis to the tube socket; remove the 2 6/32 bolts and nuts that retain the socket.

3. Use a Greenlee 1⅛" diameter chassis punch to punch the new hole. The hole for the new socket should be up enough to permit insertion of the tube without having to file off part of the base. The punch should be positioned in the hole from which the red lead was removed, as near to the chassis as possible. The female part of the punch should be in the PA cage and the tube socket with the components should be positioned clear of the male part of the punch; use a 7/16" open end wrench to turn the socket punch bolt.

4. Position the socket in the new hole and use a #27 drill to make the new holes for the socket mounting. *Caution*! Use a smaller size drill to start the hole or the bit may damage the components by drifting off the center punch indentations. Remount the socket and insert the 6DQ5 to check for any errors.

5. Punch a 2nd hole and drill the mounting holes and mount the 2nd (upper) tube socket.

6. Resolder all of the leads and lengthen them as necessary. Check the instruction book schematic and parallel the necessary pins from the lower tube socket to the upper tube socket (except the filament wiring). Connect 20 watt resistor in series with the upper tube filament pins, grounding one side and dressing the lead to the rear of the 12 volt filament supply and the male power plug. Add another braid and plate cap for the upper tube. Replace all the shields, blow out all of the metal crumbs, and check the dress of the added wiring against the pin numbers of the schematic for additional confidence.

7. Connect a power supply of 800/900 vdc @ 400/600 ma. Adjust the bias to the proper level–25 volts. Place a 1% resistor across the meter terminals so the meter reads 400 ma at half scale (200) (Total current is then meter reading times 2). Tune up the xmtr into dummy antenna on the 75 m position, with a Micromatch and Termaline preferred. Check the neutralization as in the book. Adjust the loading as usual except limit the current to 225 ma per tube instead of 275 ma.

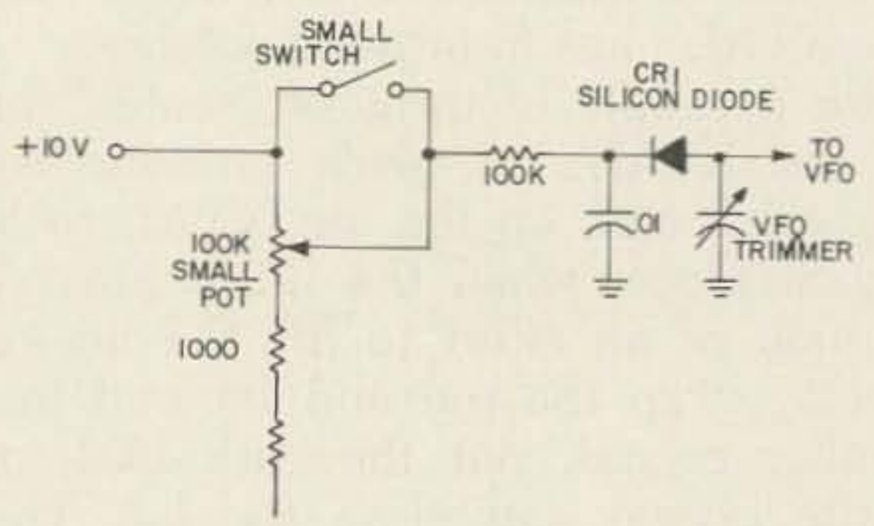
8. Connect an outside antenna and with normal speech your Micromatch should peak to 200 on a short sustained ahhhhh which is a good healthy signal on any man's band. Values of resistances for the filament circuit and meter shunt have purposely been omitted to give the reader a lil' mental exercise.

. . . KØIEG/6

SB-33 on MARS

I imagine there are at least a couple of guys interested in 4.025 mc MARS operation with their SB33's. The modification is simple, easy to do, has only six parts and it does a good job.

The small toggle switch, a Unimax Sub Miniature Snap Acting Switch #1SB-1, is mounted in the upper left hand corner of the front panel just above the dial plate. The silicon diode can be almost any standard type, a 1N456 does a good job.



1. Close S1 adj vfo trim to 4 mc
2. Open S1 set dial to marker past 4 mc
3. Adj pot until 0.025 zeros in on marker past 4 mc

. . . W6PDD

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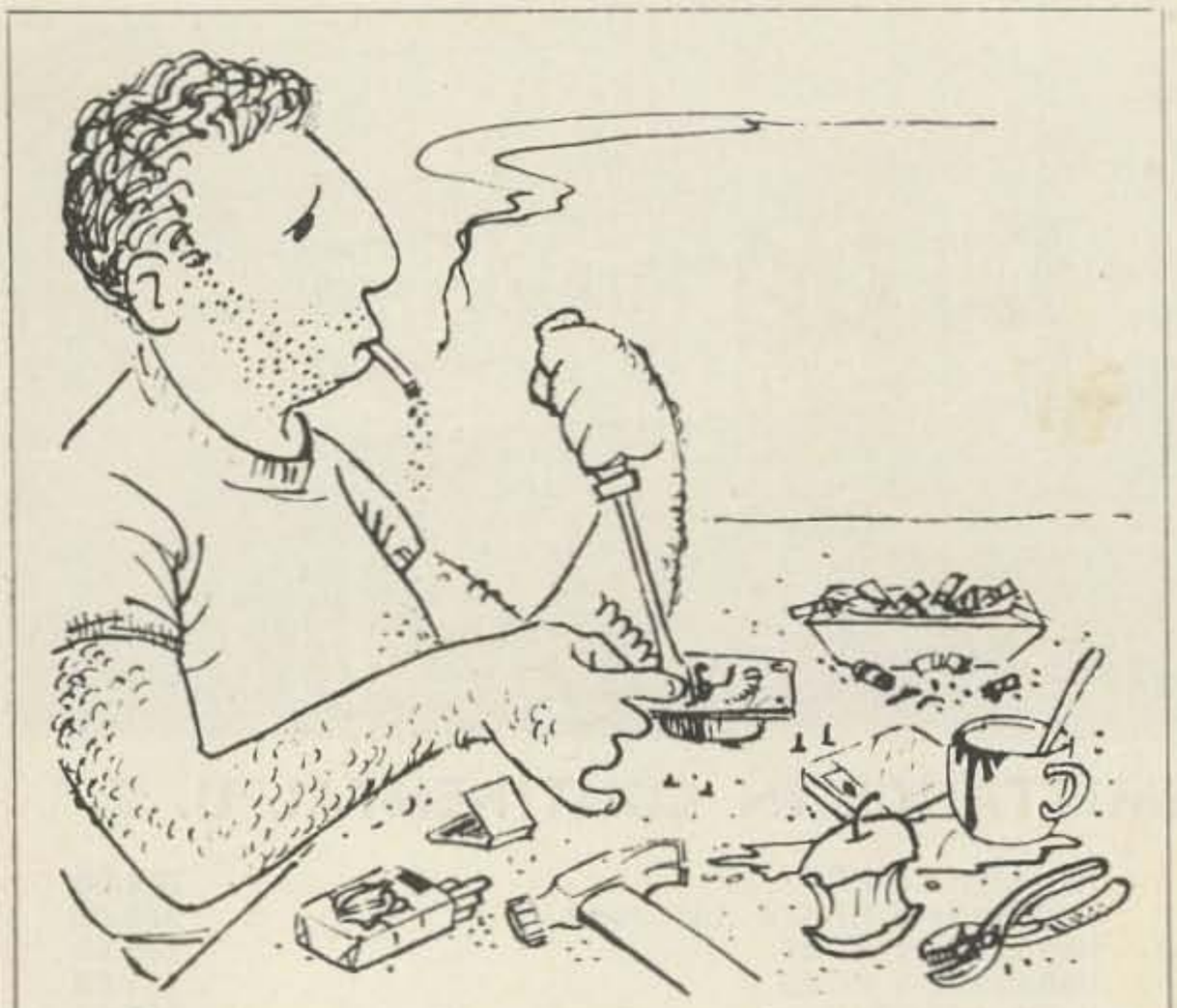


Cleanliness and a gentle touch are necessities when repairing a meter.

Cartoons by Wayne Pierce K3SUK

Amateur, Spare that Meter . . .

There are probably no pieces of electrical equipment so widely used and so little understood as common D' Arsonal meter. Most amateurs use them continually without very much thought as to how they work, and how to get the most out of them. Wide misconceptions exist about many aspects of meter usage, durability, etc.

Most well-designed units can stand a 1000% overload without suffering mechanical damage, although with ac units, rectifier damage may occur. Meters with target type pointers are, of course, less able to withstand severe overload rapidly applied. The movement upscale has very little likelihood of damaging the target pointer, but the sudden stop at the end of the travel on a suddenly applied overload is quite another thing. The target's mass may bend the pointer.

Mechanical damage by dropping is quite common, and needs no discussion.

Poor location of meters in equipment is something few amateurs consider. The meter's accuracy is entirely dependent on the flux value in its gap. While the meter designer uses material of high stability, demagnetizing can, and does occur. It is customary in a meter factory to make all units about 10% more sensitive than required. This excess sensitivity is then removed by deliberately "aging" or demagnetizing the flux producing element.

This "aging" stabilizes the magnet and assures reasonable lack of susceptibility to further flux reduction under normal conditions. Close proximity to a strong ac field, such as that produced by a motor or transformer, is not considered as "normal." Slow deterioration may occur with resultant loss in meter sensitivity and calibration error.

The use of a soldering gun in close proximity to the magnet will also cause slight flux loss due to the very high ac field present. With a properly aged magnet this effect is very small.

The life of a meter can be badly shortened, if it is not a sealed unit, by environment. Overly humid storage may cause rusty pivots and resultant friction. Steel particles small enough to be airborne can actually accumulate, over a period of time, enough to cause sticking action.

Rough handling may not cause readily observable meter deterioration. Quite often it appears only in the form of friction. This can be detected by running the meter up scale slowly, stopping, then tapping the meter—the

amount of motion after tapping bring friction error. Rough treatment often causes minute pivot blunting with resultant friction. Friction is always more of a problem with more sensitive meters, as increased sensitivity is usually achieved in a design by increasing the amount of wire involved and the flux of the magnet structure, *and* by reducing the power of the springs. The added wire means more weight, the weaker springs less torque. Result: more friction. The added weight also makes pivots more subject to blunting, so it is necessary to handle high sensitivity meters carefully.

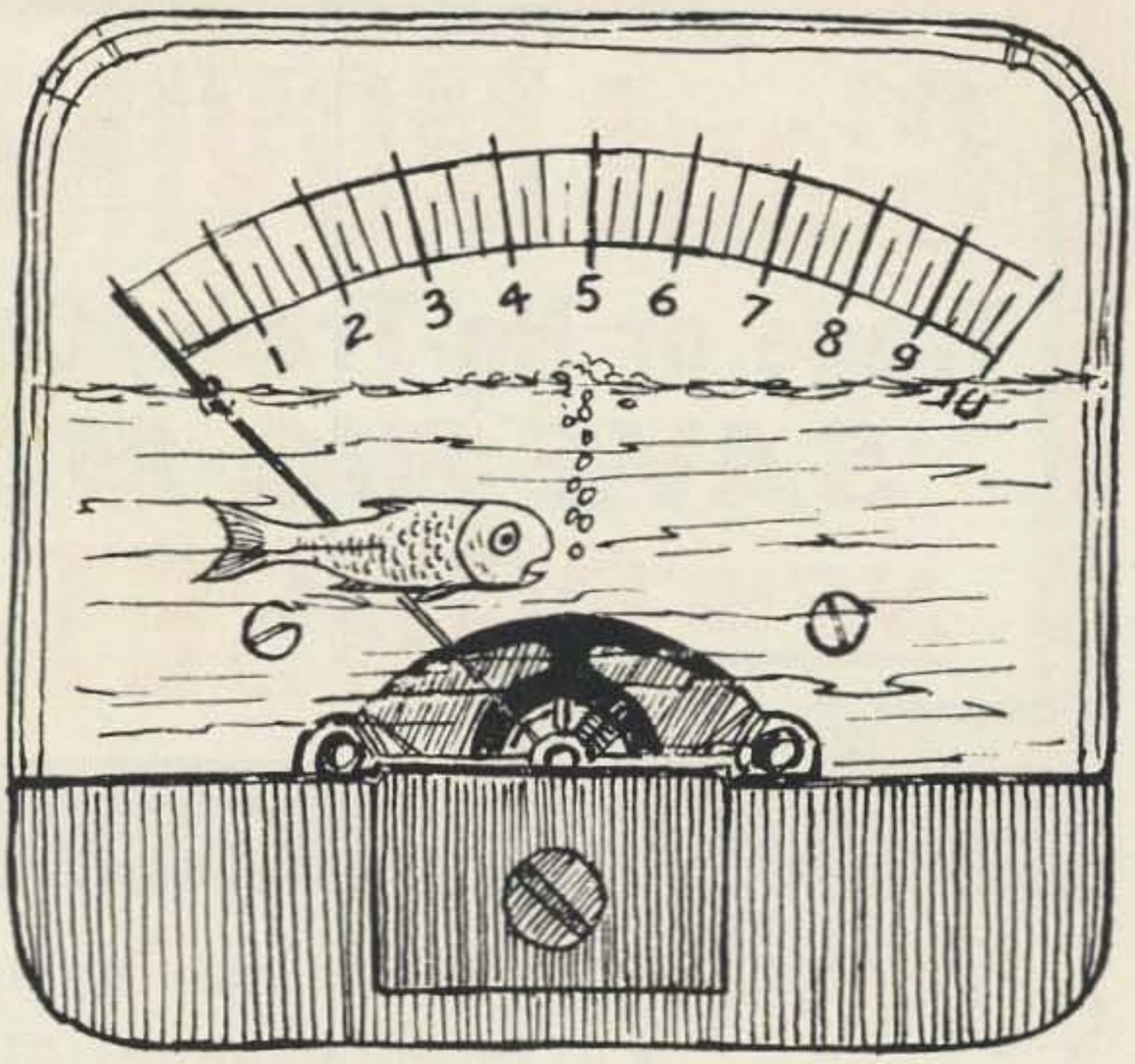
Considerable damage is done to meters by people with the best of intentions. It's bad enough to have overloaded a meter by over 1000%, but the real damage will occur when an attempt is made to straighten out the pointer. Usually such repair jobs come to grief, and there is great wonderment on the part of the amateur abruptly turned meter repairman. Why do meters always go bad when the most capable amateurs try to become repairmen?

The first disaster which will befall a meter with a bent pointer, occurs when the amateur sits down at his desk and takes the front off the meter. Unless a sheet of clean white paper was placed on the desk top prior to opening the meter, every tiny speck of steel trash in the area will jump at once into the meter. One almost invisible speck on the core will cause the meter to become "sticky."

So the meter that originally had only a bent pointer, now has an added built-in complication—a tendency towards stickiness.

If our friend did put a sheet of clean paper down, he probably forgot to demagnetize and wipe off all the steel chips from the needle nose pliers he's using.

If the meter survives thus far, the innate curiosity disease will surely set in. The first symptom of this is the observation, "Say, look at how they do this in this meter." It is natural to touch the point involved while making the observation. Such touching usually ignores the presence of the hair spring, and it gets bent. This seems to be no problem since in about



An overly humid atmosphere may cause deterioration of the meter . . .

half an hour we have it all straightened out, "as good as new," except we now have wrecked the linearity of the meter, as well as its calibration at end scale.

Oh yes, that pointer! With great aplomb it is straightened out. Of course, the meter is now off poise or balance, and won't read the same horizontal and vertical. This fault is usually not observed at first, although some fellows may wonder why the meter makers put those "silly springs" on the pointer base.

Just before the meter front gets put on for the last time, our friend will discover the little screw which adjusts the jewel. The usual reaction to this is to tighten it up just a "hair." The pointer won't wobble so much that way. Indeed, it will hardly move at all, due to the blunted pivot or pierced jewel caused by our repairman.

The front will go on for the last time now. Actually, it'll go on and off several times, since the zero adjuster usually will miss the slot. About this time it's discovered quite often that the meter won't go to zero. Remember the spring trouble and the poise?

A few minutes and cuss words later, our amateur places the meter at arm's length and admires his work.

. . . W8BPY

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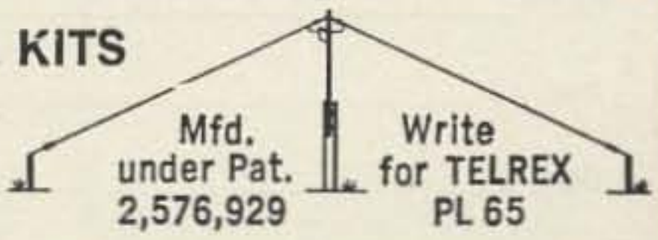

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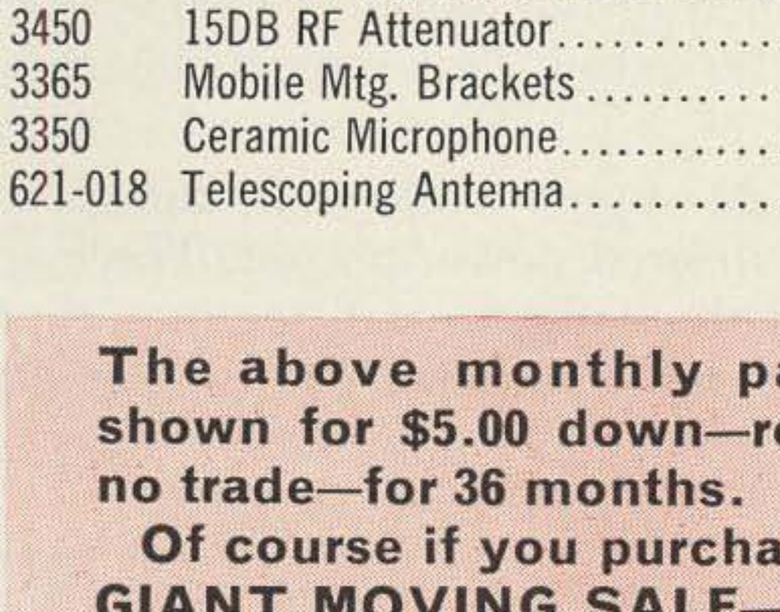

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Transistor RF Power Amplifier Design

The amateur will find solid state circuitry desirable in many transmitter applications such as oscillators, frequency multipliers and power amplifiers. Though there are similarities in tube and semiconductor circuit design, there are also very important inherent differences between transistors and vacuum tubes which must be taken into account in circuit design. Unlike vacuum tubes with high input and output impedance, the transistor is a low impedance device. The input impedance, which is dependent on frequency, may be as low as ten ohms. Collector output impedances in the fifty to one hundred-ohm range are often encountered.

Transistor circuits require crystal controlled oscillators for maximum frequency stability. Since the output frequency is often much higher than the oscillator frequency, several stages of frequency multiplication may be required.

The number of amplification stages required to obtain a specified output power is a function of the power gain of the transistor. The gain in turn is a function of frequency, supply voltage, circuit configuration, class of operation and drive power.

Operation of low level stages in class B or C is inefficient and results in low power gain since drive power is necessary to turn the device "on." Therefore low level stages can be operated in class AB. However, for high drive level, class C operation is preferred because of the high efficiencies which can be obtained.

The goals to achieve in class C amplifier design are high dc efficiency, large power output and low drive power. As is generally the case, some compromise is required to attain these goals.

Both common emitter and common base circuits are used for rf power amplifier designs. The choice is influenced primarily by operating frequency, power gain and desired bandwidth.

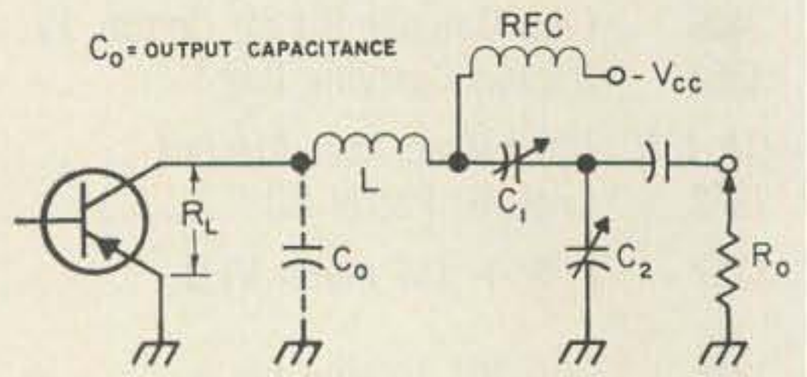


Fig.2A

Tank Circuit Design

The amplifier's output tank circuit must supply a proper load impedance and must not consume too much of the amplifier's power. At the same time the output tank circuit efficiency should be high.

Usually the dc supply voltage is known in addition to the desired power output. The load impedance that the collector will see may then be calculated from equation (1) (neglecting $V_{CE\ sat}$).

$$R_L = \frac{(V_{CC})^2}{2 \cdot P_O} \qquad (1)$$

V_{CC} = collector supply voltage.
P_O = power output in watts.

Fig. 1 is a schematic of the familiar Pi network. The formulas for calculating the reactive components C_1, C_2 L and the value of R_L are as follows, assuming V_{CC} =15v, P_O = 0.5 watts, and Q_L (loaded Q) = 5, R_O = 50 ohms:

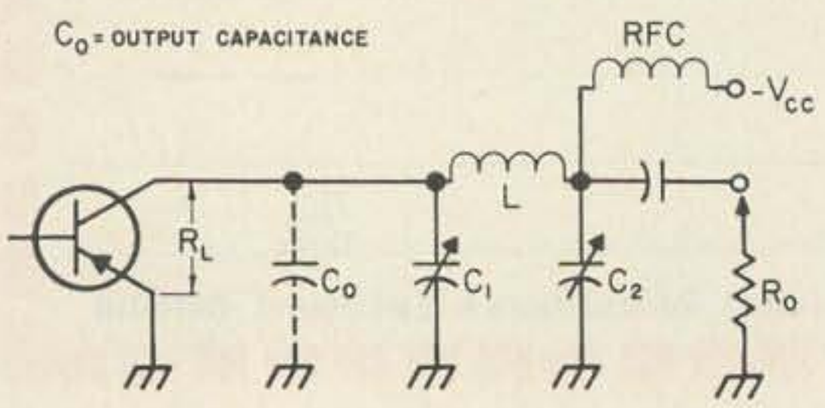


Fig. 1

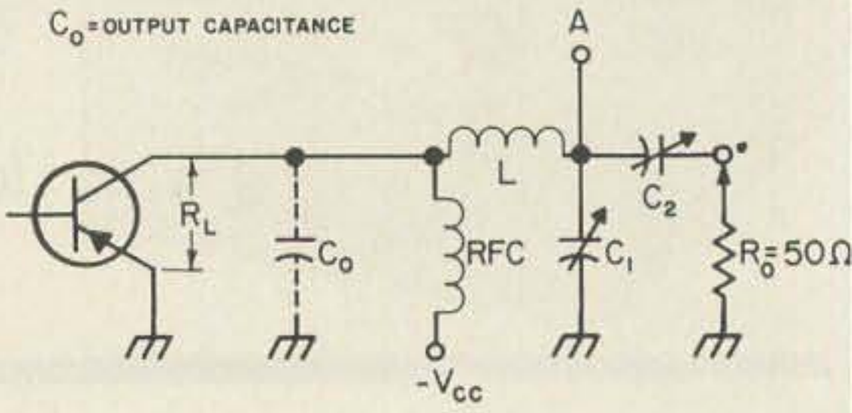


Fig. 3

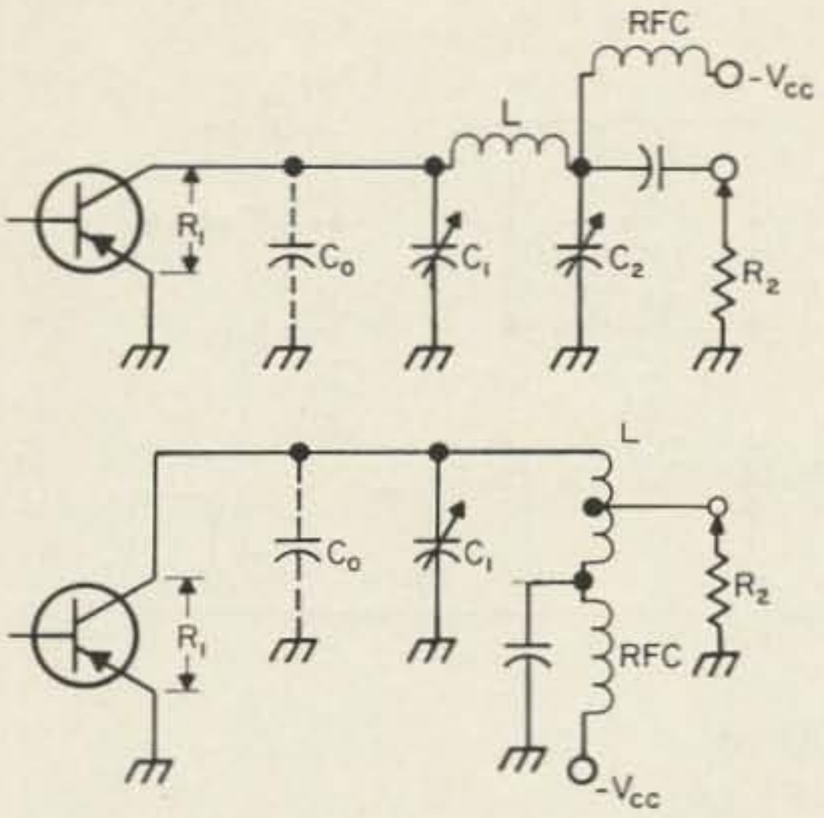


Fig. 4A

Fig. 4B

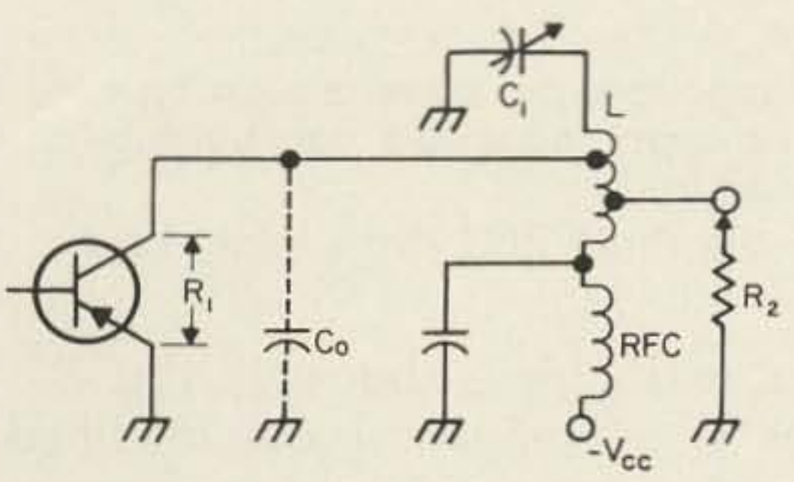


Fig. 4C

1. $R_L = \frac{V_{cc}^2}{2\ P_o} = \frac{(15)^2}{2 \times 0.5} = 225$ ohms

2. $X_{C_1} = \frac{Q_L}{R_L} = \frac{225}{5} = 45$ ohms

3. $X_L = X_{C_1} = 45$ ohms

4. $X_{C_2} = R_O \sqrt{\frac{R_L}{R_O\ (Q^2+1) - R_L}}$

$= 50\sqrt{\frac{225}{50(5^2+1) - 225}} = 23$ ohms

The output capacitance, C_o, can be a problem when designing matching networks for use at two meters or higher. The capacitance C_o is an appreciable part of C_1 when compared to the calculated value of C_1. Since C_1 and C_o are essentially in parallel they will add, and a value of C larger than C_1 calculated will have to be accounted for, and may then make the Pi network as shown in Fig. 1 impractical. Fig. 2, however, shows as alternate connection for the Pi network. The combination of L and C_1 is now a variable inductor which is tuned to resonate with C_o at the operating frequency.

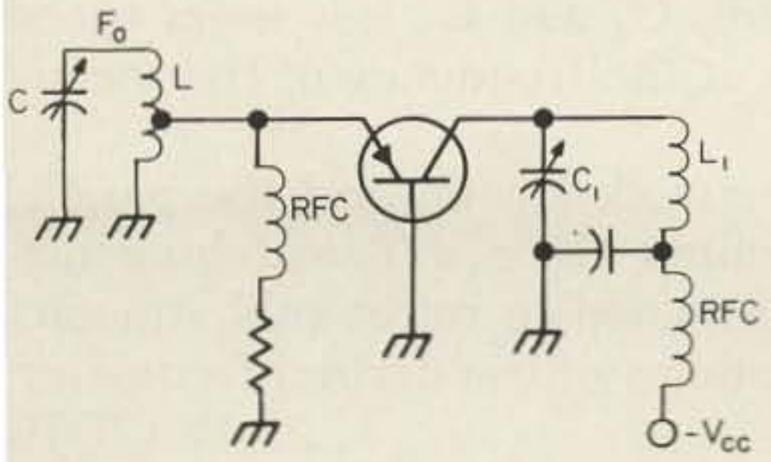


Fig. 5

The values of the reactive components are calculated as indicated for Fig. 1.

The Pi network is desirable in applications in which feed-through of subharmonics is of no consequence. In many cases, however, in which the operating Q of the matching network is very low the T network shown in Fig. 3 will better meet the needs of the problem. In such a circuit, the loaded Q is increased by raising point "A" to an impedance level of 1 k ohm (or more) and then transforming down to the 50 ohm output impedance. Tuning to resonance is accomplished by means of C_1; loading is accomplished by means of C_2.

Assuming $Q_L = 5$, $R_L = 75$ ohms and R_O is the output load, the values of the components of the T network can be calculated in following manner:

1. $R = R_L(Q_L^2 + 1) = (50)\,(5^2 + 1) =$ 1300 ohms

2. $X_1 = \frac{R}{Q_1} = \frac{R}{Q_L} = \frac{1300}{5} = 260$ ohms

3. $Q_2 = \sqrt{\frac{R}{R_L}} = \sqrt{\frac{1300}{75}} = 4.2$

4. $X_2 = \frac{R}{Q_2} = \frac{1300}{4.2} = 310$ ohms

5. $X_L = Q_2 R_L = 4.2(75) = 315$ ohms

6. $X_{C_2} = \frac{R_O}{Q_1} = \frac{50}{5} = 10$ ohms

7. $X_{C_1} = \frac{X_1 \cdot X_2}{X_1 + X_2} = \frac{260(310)}{260 + 310} = 140$ ohms

Interstage Couplings

The input network of the following amplifier must provide coupling between the driving source and the base to emitter circuit. In most applications, the load impedance of the driving stage is much higher than the input impedance of the amplifier. The input impedance must therefore be "transformed up" to the correct load impedance value for the collector circuit of the driver stage. Several circuits which will provide matching between the collector and

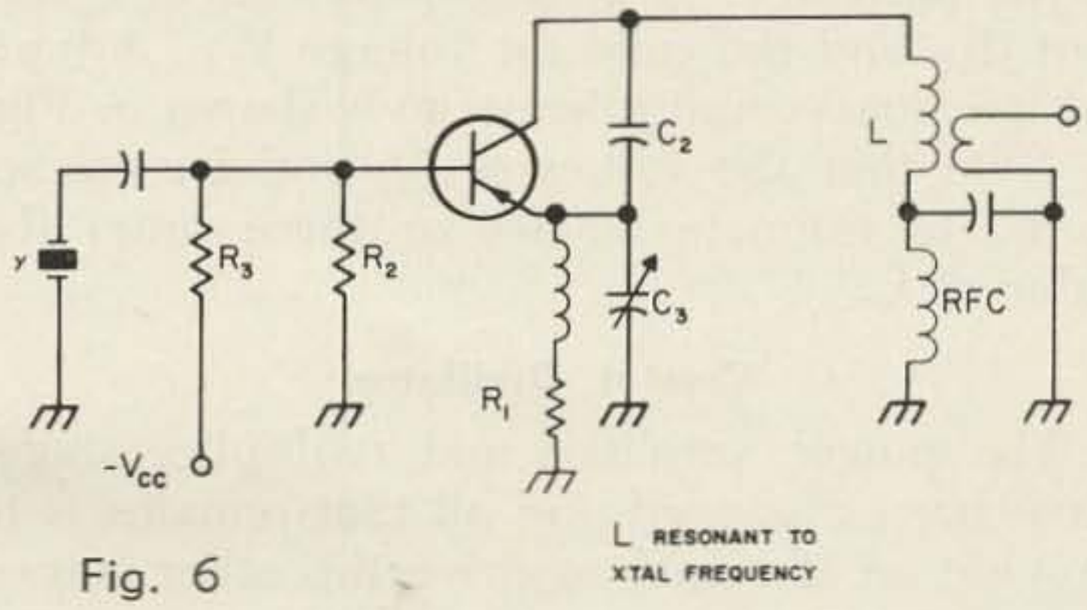


Fig. 6

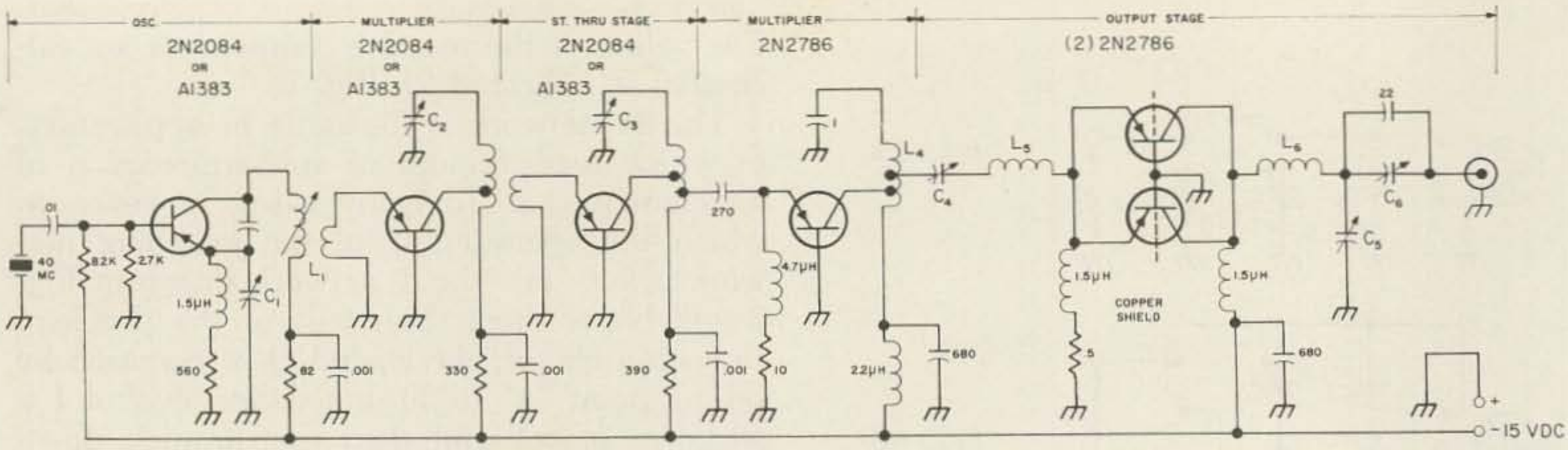


Fig. 7

L1, 7T #20E ¼" dia. close wound, 2T link #24 insulated at cold end
L2, 6T #18 bus bar, 5/16" dia. ½" long, tap 3T from ground link, 2T #24 Ins.
L3, 6T #18 bus bar, 5/16" dia. ½" long, collector tap 3 turns, base 1 turn, both taps from cold end of coil
L4, 2½T #14, bus bar 7/16" dia. ⅜" long
L5, 6, 2T #14, bus bar ¼" dia. ¼" long
C1, 6, 7-100 pf
C2, 3, 5, 4-25 pf
C4, 2-12 pf
All variable capacitors are compression type. Air dielectric type capacitors can be substituted if desired.
Heat sink for the three 2N2786's Wakefield Engr. #207.

the base-emitter circuit of the following stage are shown in Fig. 4.

Fig. 4A is a Pi network while Figs. 4B and 4C are ordinary parallel resonant tank circuits. In Fig. 4C a tap point is provided for the collector circuit. This point is best determined experimentally. It should be noted that parallel tuned circuits provide the best suppression of subharmonics.

In Fig. 4, R_1 is the collector load impedance, R_2 is the input of the next stage and Q_L is the operating Q. The values for the reactive components of Fig. 4A can be obtained by use of the following relationships:

$$1.\ X_C = \frac{R_1}{Q_L}$$

$$2.\ X_{C_2} = \sqrt{\frac{R_2}{R_1}\,(Q^2+1)-1}$$

$$3.\ X_L \approx X_{C_1}$$

Frequency Multipliers

A frequency multiplier stage is operated as a class C amplifier. The power efficiency for a multiplier (as is the case for any class C amplifier) is a function of the conduction angle of the individual stage, the peak collector current, I_M, and the collector voltage V_{CC}. A typical frequency multiplier stage is shown in Fig. 5. Note that the values of C_1 and L_1 are selected to resonate at two or three times the value of f_o.

Crystal Oscillator

The power amplifier and multiplier stages have been discussed and all that remains is to provide an rf signal to drive the other stages. A typical crystal oscillator is shown in Fig. 6.

The oscillator is a common base, modified Colpitts type, with the crystal used in a series mode. R_1, R_2 and R_3 provide the transistor biasing, and the feedback is determined by the ratio of C_2 to C_3. The values of C_2 and C_3 also depend upon the power output and frequency stability desired. Frequency stability is further assured by using a small collector current swing and loose coupling between the oscillator and multiplier circuits. The loose coupling will insure that loading effects of the multiplier on the oscillator are negligible.

Conclusion

The various stages discussed in the previous paragraphs have been treated in a somewhat general manner since individual requirements such as components, frequency, etc. must be considered.

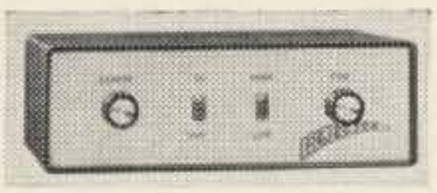
Fig. 7 is an overall schematic of a complete CW transmitter in which the various stages have been combined. It should be noted that this design is only representative of how the final result would appear. The values for the capacitors and coil data given are for 160 mc. Most adjustments will hit 2 meters without much trouble.

The output stage is composed of two class C amplifiers connected in parallel. They are slightly back biased by the 0.5 ohm resistor in the emitter circuit. C_4 and L_5 is a series tuned circuit, resonant at the frequency of the second multiplier.

The output network L_6, C_5 and the parallel combination forming C_6 is a T matching network which is designed to reject subharmonics and higher harmonics of the desired frequency.

. . . WA2DJU

New Products



Galaxy Rejector Notch Filter

Galaxy Electronics has introduced the Rejector, a tunable notch filter. This seven transistor notch filter greatly improves the reception on any ham receiver or transceiver. The Rejector is tunable from 300 to 5000 cycles to suppress heterodynes, QRM, ignition noise, background noise and other irritating receiver interference by over 40 db. It connects between the receiver output and speaker. The front panel is reversible for either horizontal or vertical mounting. It's only 7½ x 5⅜ x 2½. Price: $34.95. You can get more information from Galaxy, 10 South 34th St., Council Bluffs, Iowa.

New Amperex SSB Tube

By now, most hams know that there is more to a sideband amplifier than its power output. Amperex' new 8579 beam tetrode is designed to give excellent linearity in SSB service up to 60 mc. A special geometry has been used to keep third order distortion products better than 30 db down. The 8579 can supply 110 watts PEP in AB_1 SSB CCS service. In class C, it gives 110 watts output with only 600 volts on the plate. AM rating is 94 watts and it also makes a fine modulator. The tube is highly efficient and its low drive requirements simplify driver design. The 8579 has double ended construction, a common basing arrangement and a hard glass envelope. Price is $21.50. Amperex at Hicksville, N. Y. can give more information and data sheets.

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Some Worthwhile Seneca Modifications

Having owned and operated a Heath Seneca for the past two years the author has made numerous modifications to the original unit that have proved rewarding and worthwhile.

For those Seneca owners who may wish to incorporate part or all of these modifications, the following pages will explain how it is done.

Audio Stage Improvements

To preclude the possibility of rf getting into the audio section of the Seneca, add an rf choke in series with the .001 mmfd input capacitor, C28. If you intend to operate primarily on two meters, use an Ohmite Z-144, otherwise a Z-50 should be used.

To reduce hum and incorporate additional B+ filtering two components are added. Refer to pictorial 14 on page 38 of the Seneca manual. The following steps are taken:

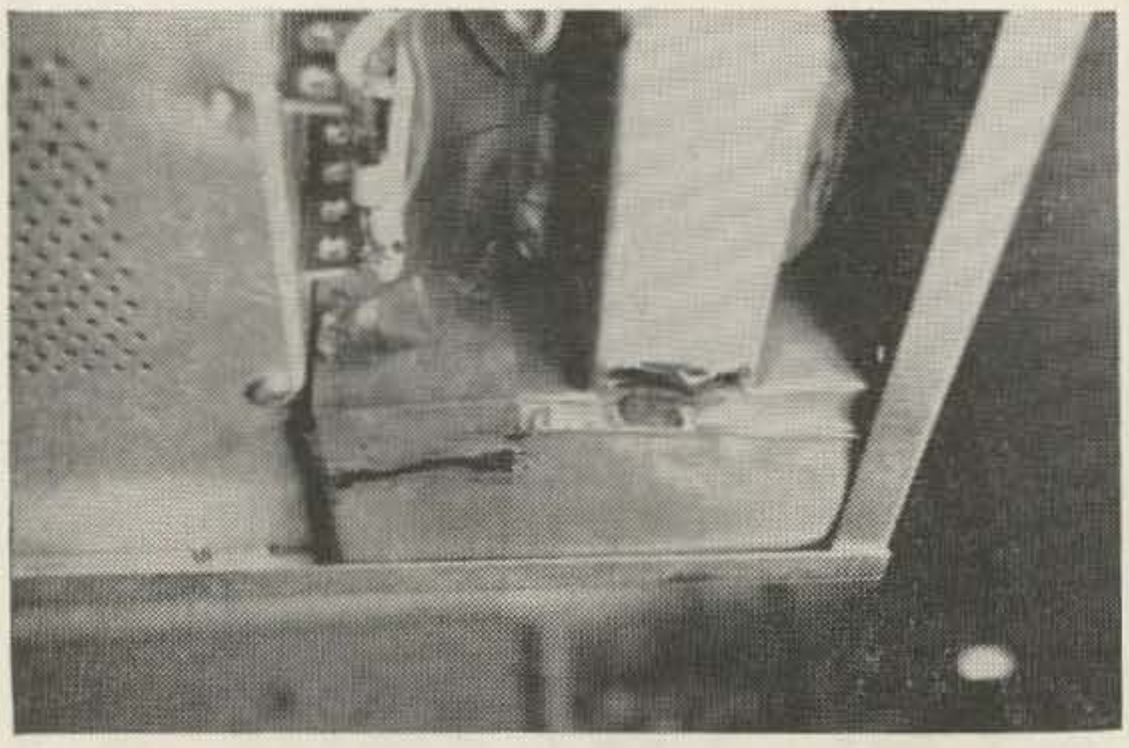
1. On terminal strip AA remove the orange jumper between terminals two and four.

2. Replace the orange jumper with a 2-watt 15K or 20K resistor. Solder the connections at terminal four (there will still be three wires on this terminal).

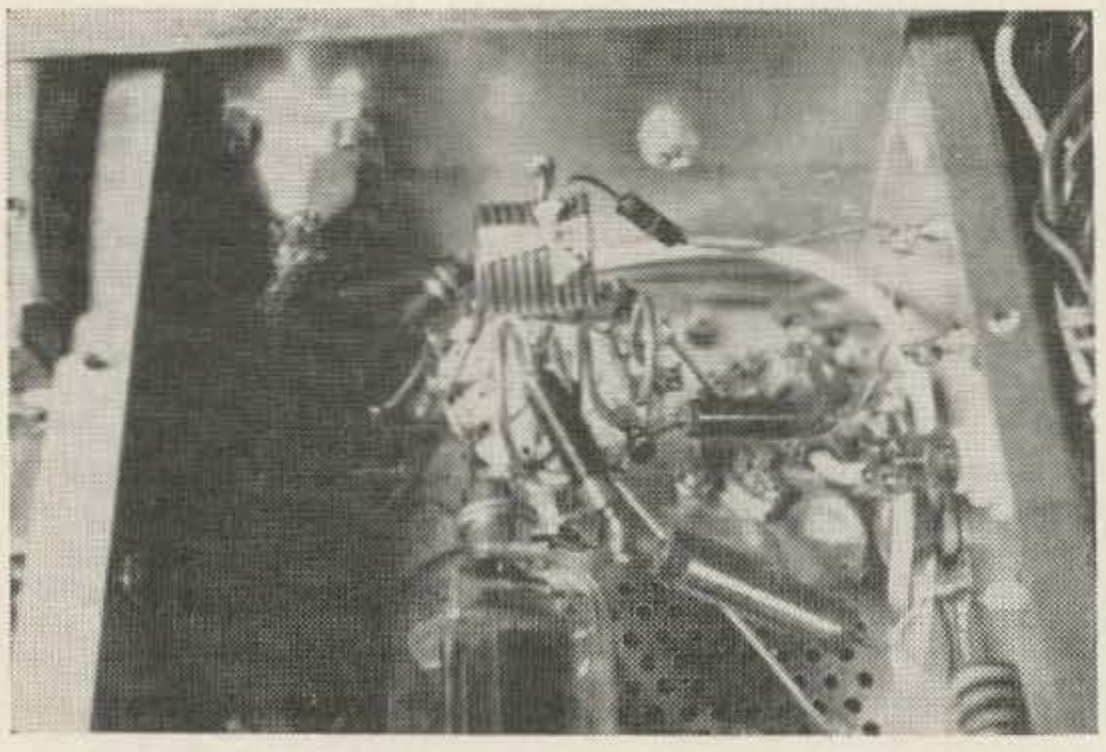
3. Solder a 10 to 15 mfd/450 w vdc—smallest size possible—electrolytic capacitor to terminal two (again, there will be three wires). The negative (-) side of the capacitor is soldered to the most convenient ground point available.

This added filtering and decoupling will reduce existing hum and perhaps some improvement in the audio quality will also be noticed.

Before making the above additions to the

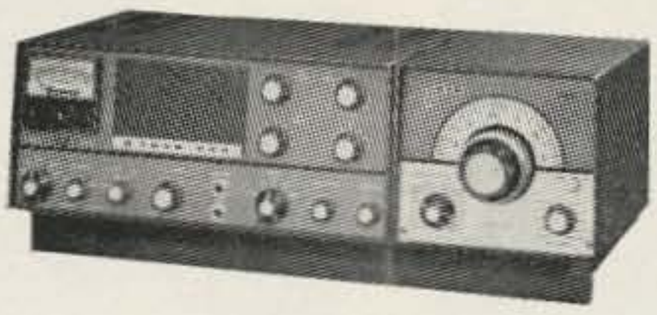


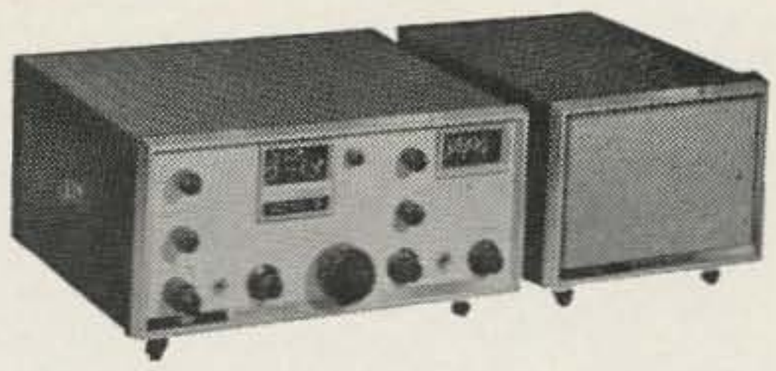
Copper shield around audio stage is shown soldered in place. Note that shield is soldered directly to the choke case.



Note lacing cord tied around grid coil L9 compressing the coil for maximum grid current.

TRANSCEIVER HIT PARADE





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The front panel crystal socket is mounted directly below the power on pilot lamp and to the left of the meter switch.

audio stage of the Seneca it may be necessary to remove the parallel 6.8K resistor and 2 mmfd capacitor. If you do, don't forget to replace them.

Whatever hum may remain will undoubtedly be removed by the following:

The low voltage filter choke is located next to the audio section and is isolated by cutting some copper sheet stock and completely enclosing the audio section as shown in the photo.

Referring to pictorial 18 on page 52 of the Seneca manual, it can readily be seen that the choke, 46-22, is a most likely suspect in the cause of hum. Be sure that your shield is on the audio section side of the choke and that it does not short out any components.

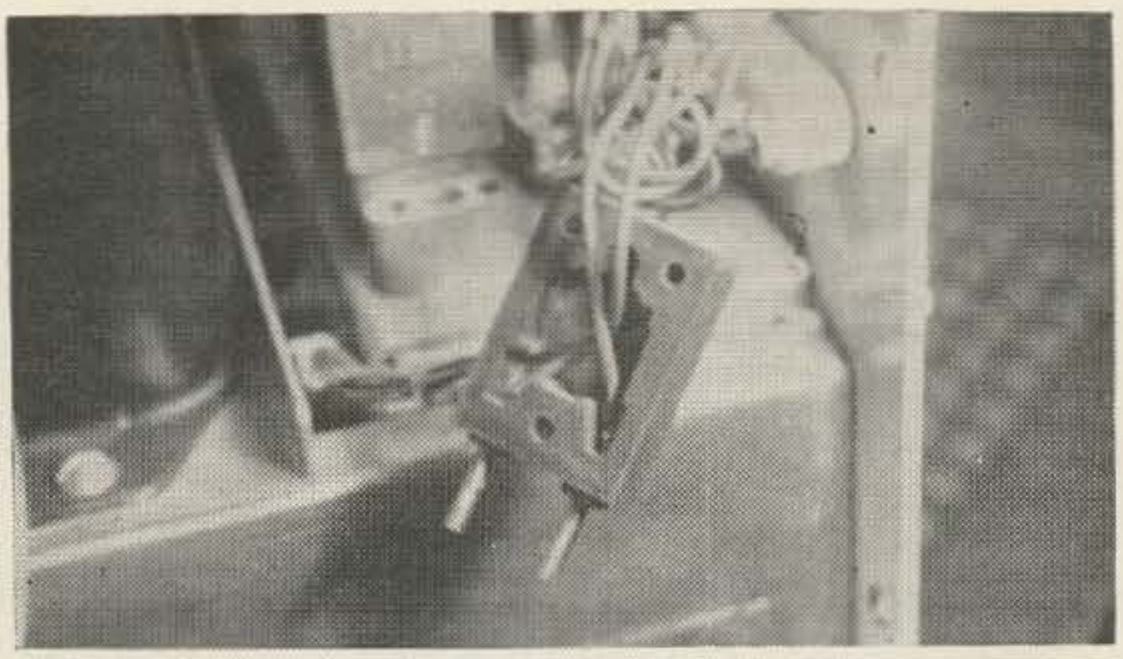
Solder the shield directly to the top of the filter choke and at two or three places on the chassis that are convenient. The shield will be mostly self-supporting if cut a little oversized and forced into position. The shield is quite effective in eliminating hum introduced by the filter choke.

Lack of Grid Drive?

A number of Seneca owners have complained of a lack of grid drive. Adjusting coils L7, L8 and L9 according to the manual instructions may help but in too many cases it seems that coil L9 wants to be compressed beyond its capability.

This was the case with the author and several other local Seneca owners. The solution?

Take a short length—about 12 inches—of nylon lacing cord and tie the coil into the desired compressed position. This is done with the B+ off of course. A little experimenting here with the lacing cord position and tension will disclose the optimum condition which will deliver grid current plus. Of course you should first check the 2E26 to be sure your lack of grid drive is not just a flat or mushy tube.



"Dummy" FT-243 crystal holder with cover removed to accomodate new leads.

Adding a Front Panel Crystal Socket

Probably the most inconvenient feature of the Seneca is that of changing crystals. Although this can be done through the top access cover—(we've done it, but don't recommend it)—it certainly leaves much to be desired and may cause many gray hairs to sprout. Crystals may also be replaced by removing the chassis itself. Remove the front panel screws and the rear apron screws and slide the unit out of the case to make the crystal sockets accessible.

A simpler and more desirable feature would be to have a crystal socket on the front panel. Why not? This inolves only about 30 minutes of labor to mount the crystal socket.

The best position for the crystal socket is directly below the power on light.

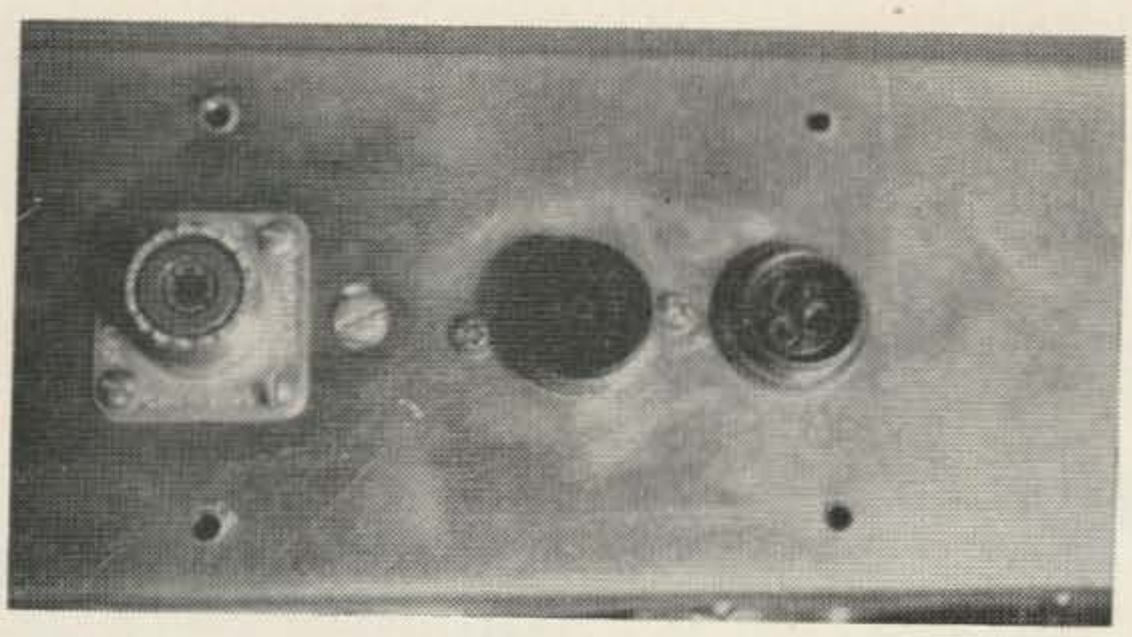
Make yourself a template of the crystal socket you intend to use and gently center punch the points to be drilled. Center punching is almost a necessity to avoid the drill skidding and marring the panel. *Before drilling*, be sure the area directly behind the proposed crystal socket is clear or you may find yourself rewiring the meter switch harness.

After the panel has been drilled and the socket mounted, it will be necessary to make the connections to the front panel crystal socket.

This can be done by wiring directly to the XTAL-VFO selector switch, or a "dummy" crystal may be inserted into one of the original crystal sockets and leads brought up and soldered to the new crystal socket. This is made by removing the crystal cover and insides from an FT-243 crystal holder. Solder new leads to the pins of the FT-243 "dummy" of sufficient length to reach the added crystal socket and solder.

Going to Plate Modulate?

The merits of plate modulation versus controlled carrier modulation have been written about many times so we'll bypass that for



Connector for modulator is mounted between the mike connector and coaxial connector.

now. If you want to plate modulate the Seneca it will be necessary to do the following:

1. Break the plate B+ connection to the 6146's and insert the modulator leads.

2. Replace feed-through capacitor FT-15 with a unit of higher voltage rating—preferably 3KV. The original 1KV unit just won't stand the gaff when plate modulating. This can be done easily by installing one of the standard ceramic feed throughs and by-passing with a .001 mmfd 3 KV capacitor.

3. Installation of a two-pin connector on the rear apron of the Seneca chassis to accept a mating plug from the modulator. The author installed this connector between the mike connector and coaxial connector.

4. Disable the existing Seneca audio. This is best done by simply removing the 12AX7 and 6DE7 from their respective sockets.

After you have installed the modulator connector, refer to pictorial 18 of page 52 of the Seneca manual.

1. Remove the orange lead between terminal 4 of terminal strip DD and terminal 1 of terminal strip BB.

2. Connect a lead from terminal 4 of terminal strip DD to one of the pins of the modulator connector and solder. (This will be the connection to the low side of the modulation transformer secondary).

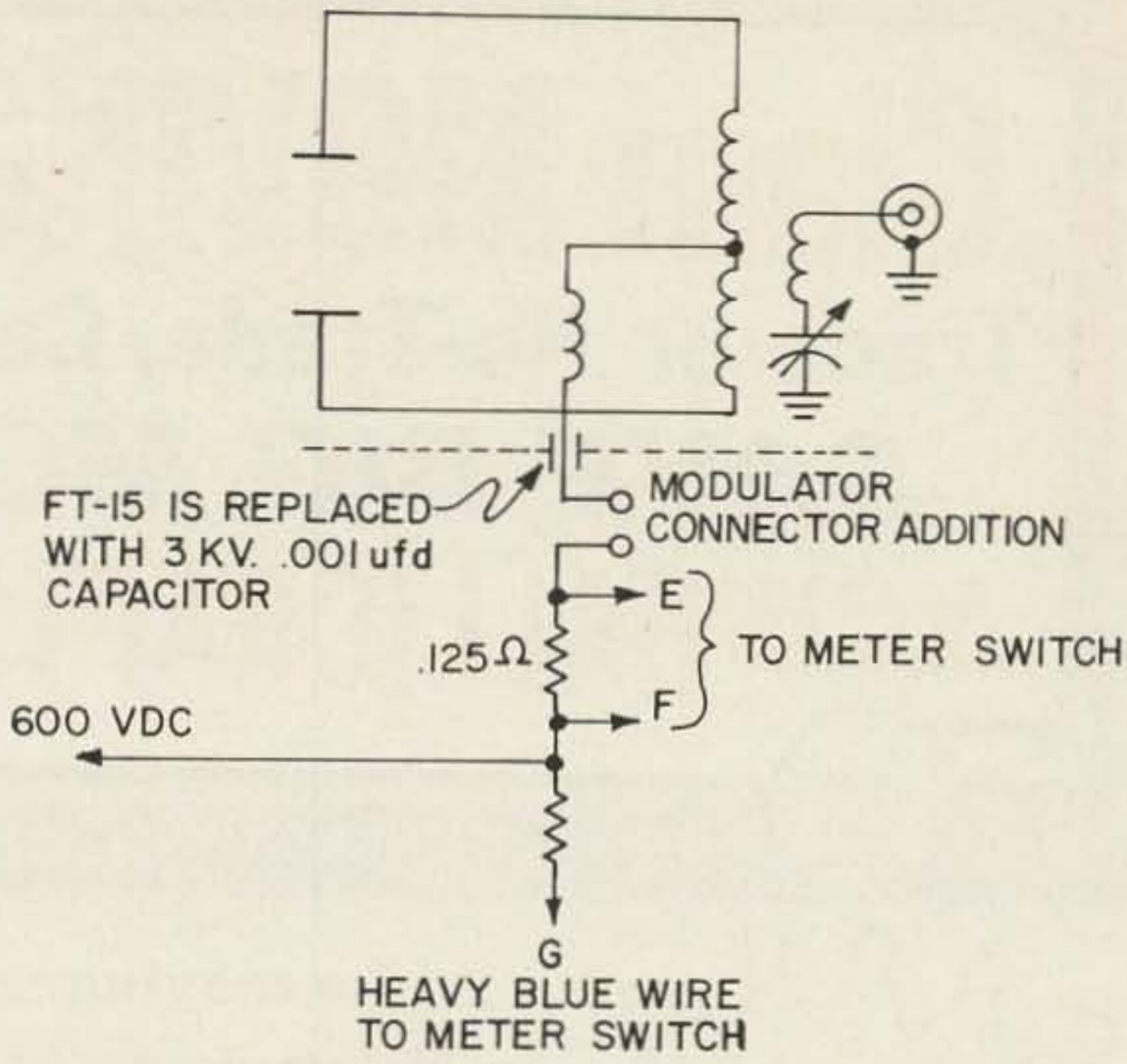


FIG. 1

Fig. 1: Schematic diagram showing modulator connector inserted in 6146 B+ line.

3. Connect another lead from terminal 1 of terminal strip BB to the other pin of the modulator connector and solder. (This will be the connection to the high side of the modulation transformer secondary).

Be sure to use good quality high-voltage wire. The type used by the author is test lead cable. This is very good and has a breakdown of 10KV or better.

With this done the modulator may be connected to the Seneca by using a mating plug. Polarized plug and connector are recommended to insure that correct connections are made at all times.

If you decide that you want to revert to controlled carrier operation, put the 12AX7 and 6DE7 back and insert a "shorted" plug into the modulator connector.

Fig. 1 shows the schematic result after adding the modulator connector.

In conclusion, I would like to say that I have made all of the foregoing modifications and am most pleased with the results. There has been a minimum of alterations to the original unit and the re-sale price—(if you ever think of selling the Seneca)—should be maintained if not improved.

Our thanks to Sal, WA6PMP, for his suggestions on improving the audio section and the reduction of hum. 73.

. . . K6VNT

Original feed thru capacitor is replaced with ceramic feed through and 3KV .001 mmfd capacitor.

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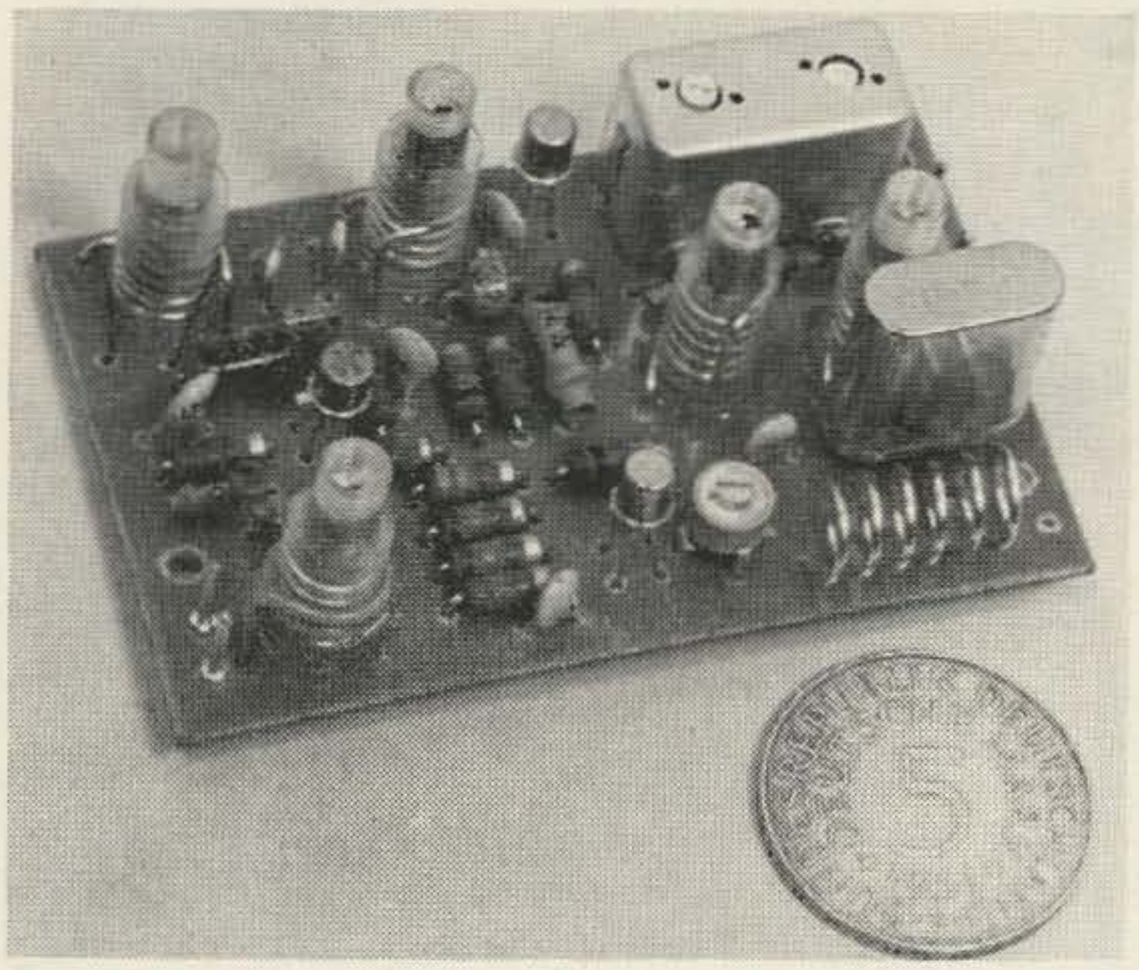

Ulrich L. Rohde
Technical Consultant
German Amateur Radio
Club (DARC)

A Low Noise Transistorized 2 Meter Converter

The electrical performance of modern vhf transistors and their low price now encourage many hams to use them for a number of applications—especially in vhf converter circuitry for 2 meters.

The information given here covers some of the important details of a German 2 meter converter, fully transistorized that has a noise figure of less than 2 db.

This converter compared with one using the famous 417A tube proved to have not only a lower noise figure but also the ability to handle high input signals with amazing linearity.

Glancing at **Fig.** 1, one can see that the input circuit has a transistor with a series resonance circuit between base and emitter and this is "grounded" by a capacitive voltage divider. Since the emitter configuration requires neutralization, the base configuration has lower amplification but the compromise is a good one. This compromise provides better noise attenuation and better impedance matching. Furthermore, the combination affords a means for feed-back compensation and allows stable operation.

The diode shown connected to the base of the AF-139 transistor is used to provide a distortionless signal to the mixer; but its main purpose of course is to reduce cross-modulation generated mixer products.

A high Q bandpass coupling circuit is used between the rf amplifier and the mixer. The bandwidth of this circuit is ±1 mc. Measured image rejection is greater than 50 db.

Additive mixing is used applying 170 mv of rf signal from the oscillator to the base of the mixer transistor. For distortion free operation high emitter current is used on the mixer.

The output bandpass filter in the mixer output at 29 mc has a bandwidth of ± 3 db.

In designing the converter, the most difficult problem encountered was the design of the 116 mc oscillator. In order for it to operate properly the frequency accuracy had to be within ±15 cps in the temperature region ±5°C (41°F) and 50°C (122°F). The average production tolerance could not exceed 100 cps and this could only be achieved by a very expensive crystal made especially for the set in Germany by a firm which only

BATTERY*	R1	R2	R3
6 VOLTS	4.3K	3.9K	3.9K
9 VOLTS	8.2K	6.8K	6.8K
12 VOLTS	12K	10K	10K

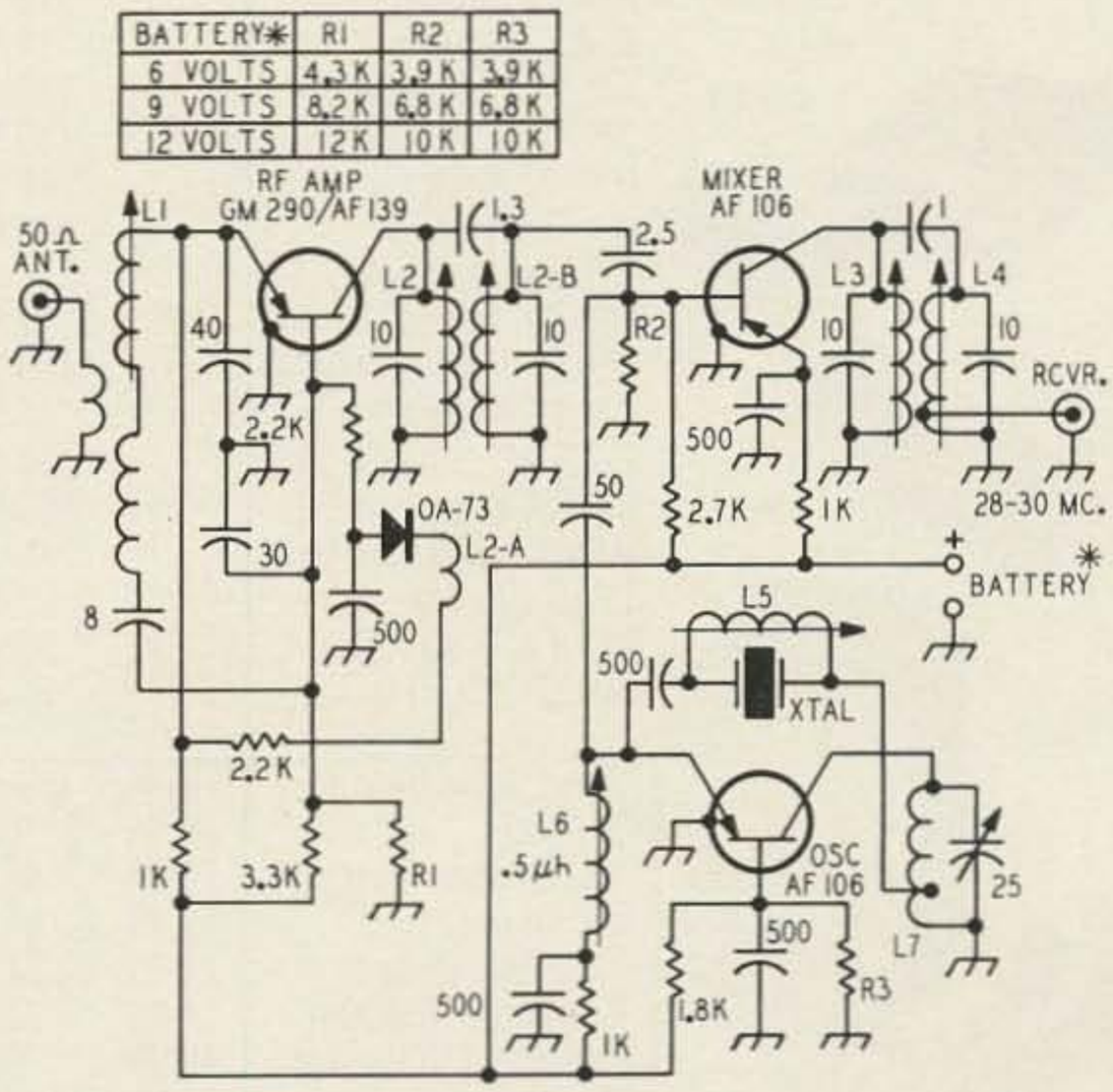

Fig. 1. Two meter converter.

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CB-9 "Deluxe" CB-7	(4.51)	129.95
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CB-6 100 mw ea.	(1.98)	$ 59.95
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produces frequency standards equipment. The crystal used operates at the 5th overtone and produces *no* spurious signals.

The ultra low noise figure (better than 2 db) was achieved by using a special Texas Instruments transistor type GM-290 (uhf-tv-type). Better attenuation of cross modulation and better signal handling capability can be obtained by using the Fairchild IW-8343 (uhf-silicon) epitaxial-planar type. Amperex A1220 is another equivalent.

The mixer and oscillator transistors are not critical but should have an f_T higher than 250 mc. Amperex 2N2495 or 2N2496 are direct equivalents.

The size of the converter is very small, only 2" × 3⅛" and weights only 46 grams. A glance at the photo of the converter with the 5 mark piece (about the size of the American half dollar) shows the neat layout of all parts on the printed circuit board.

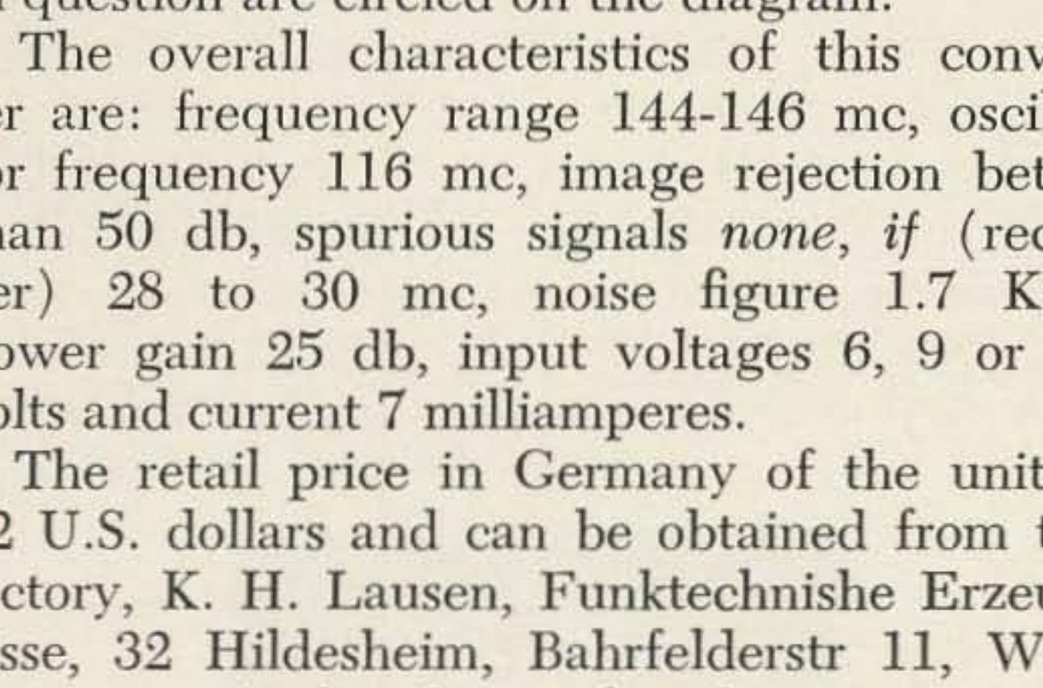
The coils L-1 through L-6 are special units. No data is given here on the coils for competitive reasons. You'll have to dip them if you want to build the converter.

Fig. 2 shows that R-1, R-2 and R-3 should be changed for optimum operation when using different battery voltages. The resistors in question are circled on the diagram.

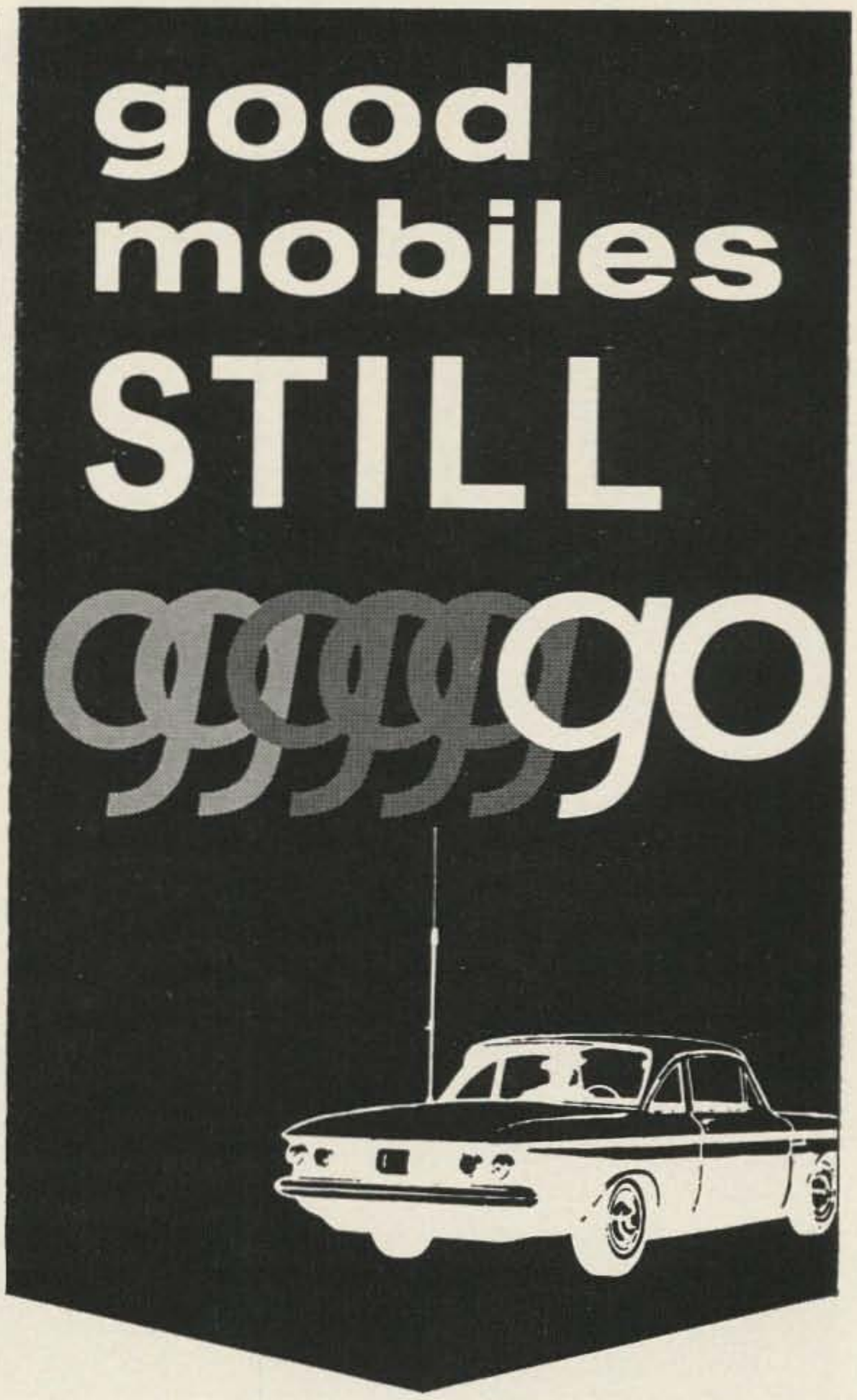
The overall characteristics of this converter are: frequency range 144-146 mc, oscillator frequency 116 mc, image rejection better than 50 db, spurious signals *none*, *if* (receiver) 28 to 30 mc, noise figure 1.7 KT_o, power gain 25 db, input voltages 6, 9 or 12 volts and current 7 milliamperes.

The retail price in Germany of the unit is 32 U.S. dollars and can be obtained from the factory, K. H. Lausen, Funktechnishe Erzeugnisse, 32 Hildesheim, Bahrfelderstr 11, West Germany. A distributor for the unit in the U.S. is being selected.

. . . Rohde



. . . K3SUK



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FCC EXAM: 0900 Saturday, April 10. General Class only. Make exam application in advance to 8th District Engineer in Detroit. FCC will issue exam papers.

For information, map, accommodations, write: Dayton Hamvention, Department T, Box 44, Dayton, Ohio 45401

Letters

advised by my lawyers that
don't you ever proofread y
are a bunch of crooks and
thi[illegible]for
have no other recourse but
should be tarred and feath

Dear Wayne:

I was intrigued by your article on page 52 of March "73" Magazine. Mr. Ackerson did a nice presentation but it won't work since the ten diodes in half of the bridge will blow on the first half cycle. The bottom diodes are all reversed. Apparently Mr. Ackerson thinks along the same lines we do since even the case, method of mounting the 100 mfd capacitors and parts list are strangely similar to our old Model 250-AC and later 350-AC.

Best regards,
Bernard J. Bisnett, President
Linear Systems, Inc.

Dear Wayne:

I noticed that the price of QST has been raised to 60 cents. I stopped subscribing to their magazine over 4 years ago. One reason for this was that their circuits were so elaborate it would be cheaper to buy commercial gear than to homebrew.

I have successfully built several pieces of gear from your magazine, including a SSB transmitter which is doing a fine job and has since last August. Please keep your magazine practical so that the average ham can build equipment from it.

Your price only went up 3 cents in a great number of years . . . A fine magazine . . . keep up the good work.

Samuel Armstrong WA2JVE

And we went up from 37c to 40c mainly because of the coin shortage which made giving 13c change a lot more difficult than a dime.

Dear Wayne:

Just received the Feb. issue. It is really great. I especially concur with your comments on the stamp. It is almost an insult. I couldn't believe my eyes when I first saw the thing.

Keep up the good work with 73. It is really different to find a good ham magazine in the mailbox with QST.

Charles R. Cox, K8TUO/AREA
Athens, Ohio

Dear Sir,

I am one of your readers and I am enclosing herewith a snap of my SSB generator which gives 50 watts output on 14, 21 & 28 Mc band using Collins mechanical filter and 7360 as balanced modulator. Results are just wonderful. This is an 1965 edition from VU2CQ. I do have two other side band generators, one phasing type and another high frequency filter type.

"Mickey" Mozoomder VU2CQ
Bombay, India

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Dear Wayne;

I am certainly not trying to tell you how to run your business but that thing of "Big Brother" re advertising in the current issue makes me mad. Why don't you ask your readers to always mention "73" when ordering equipment?

I have just ordered a VENUS and told them it was because of the write-up in the Dec. "73." I also ordered a "22'er" and told them it was because of the write-up in the current issue of "73."

I ALWAYS say it was because of "73" whenever I write or order—(even if I saw it in "QST"!!!)

Keep up the good work!

Wilmer W5VV
Austin, Texas

Dear Wayne,

Keep up the good work and the fine articles in 73. I want to belatedly thank you for the restoration of the propagation condition forecasts. And for your information, an **official** first day cover for a stamp is available to anyone merely by sending the amount of the stamp and a self-addressed envelope to the postmaster in the city of issue. If one wants a cacheted envelope there are many commercial firms that supply them for all commemoratives issued. The ARRL statement that "official first-day covers are available **only** from the League" (italics theirs) is a lie. I would like to know how much they made on that little deal and if they really thought no stamp collectors were hams.

William Farone W5NOK
El Paso, Texas

Dear Mr. Green:

I am an avid follower of your magazine in the Charlotte area, and I would like to say it far surpasses the other same publications in this field. The content is quite informative for the "learning" amateur and complex enough for the old "pro." Even your advertisements prove very interesting. I would like to thank you for this from the Charlotte hams.

Ted F. Goldthorpe, Jr., WA4VCC

Dear Wayne,

I have one gripe. As soon as I open your magazine and I see a hastily thrown together rig using a 2C39 and globs of solder I figure K1CLL has been at work. In general it tends to degrade your otherwise excellent magazine and the overall picture of VHF-UHF construction.

Ken Decker WA6OSB
San Diego, California

Being contrarywise by nature I say a minimum of three huzzaws for Bill and his scissors and solder UHF construction techniques. Sure, I love the look of that beautifully machined brass equipment, but I know that if that is the only thing I publish we are not going to have many fellows on the UHF bands. Bill has shown that anyone can build UHF gear that works well and do it on the kitchen table.

Dear Mr. Green,

You have often spoken well of the Swampscott Convention in your magazine. I have been to the Hudson Division Convention and was very disappointed. I am thinking of driving up from New York if it is worth the trip. What organization do I get in touch with beforehand?

Bert Lane W2HBQ
Wantaugh, New York

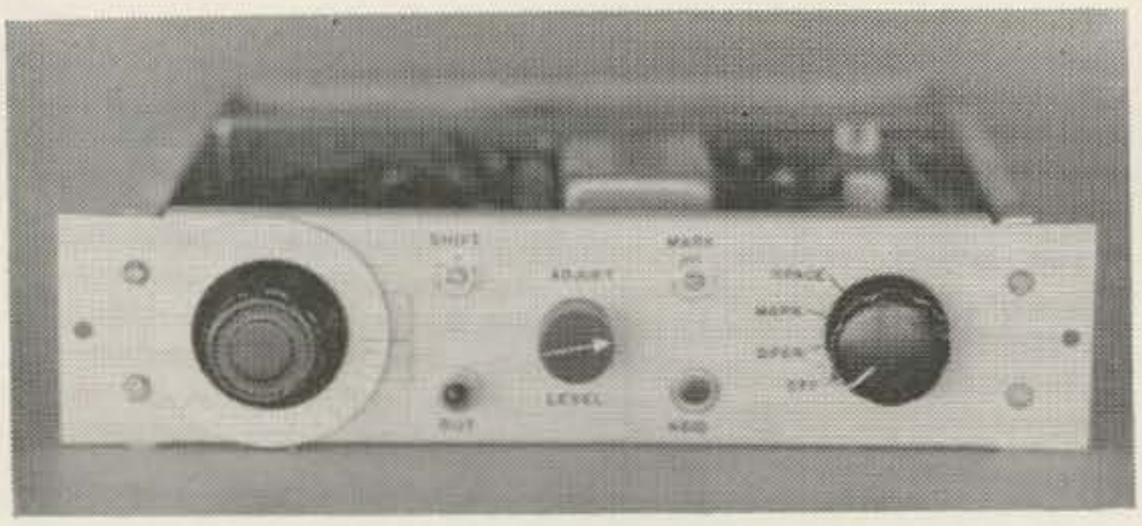
For Heaven's sakes don't miss the biggest convention of them all at Swampscott's New Ocean House April 24-25th. I'll be on the speaker's program and have a big booth there to say hello. Write to Eli Nannis W1HKG, 37 Lowell Street, Malden, Massachusetts for further info and be sure to come on up with the family.

Gentlemen:

K4NMV, 1736 28th Street, Ensley, Birmingham, Alabama has available at no charge copies of a callbook of amateurs belonging to the Church of Christ. Please send a #8 stamped self addressed envelope.

K4NMV

More letters on p. 82.



Tom Lamb K8ERV
1066 Larchwood Rd.
Mansfield, Ohio

A Novel AFSK Oscillator

Let's see, this morning I'll build an audio shift oscillator for the expected model 15, and this afternoon I'll . . . As with most projects, building a good AFSK oscillator turned out to be more than a one-morning job.

The standard capacity-switched L-C oscillator left much to be desired. Switching a discharged condenser into an oscillating circuit causes a pause in the oscillation, resulting in a shortened *mark* pulse. Switching transients above the normal output level were seen, which can cause overmodulation or require operation at reduced modulation levels. The switched-C oscillator does not normally have equal *mark* and *space* output levels, and cannot easily be adjusted to exact frequency. It does have the advantages of simplicity and excellent stability.

Next I tried a Clapp vfo, using a three-gang variable condenser to permit variable shift and easy adjustment. The switching transients still existed and the *mark-space* output varied widely.

If the added *mark* capacity were very small compared to the normal circuit capacity, the oscillator circuit Q and impedances would be nearly constant and there would be no switching problem. A large shift can be obtained from a very small added capacity only if the operating frequency is high, as in a beat-frequency audio oscillator (remember them?). Such a shift bfo was tried and produced an excellent switched waveform having easily adjustable shifts. Unfortunately even a carefully designed transistor bfo has very poor long term drift problems that make it unsuitable for RTTY work.

But cheer up, don't throw away your printers (unless you throw them my way), things are getting better! There is one type of oscillator admirably suited to AFSK service, but apparently never used. It has good stability, constant output, shifts instantly and without transients, and is quite easy to shift and adjust—the lowly relaxation oscillator!

Look at the characteristics of two relaxation circuits, Fig. 1. The neon bulb is probably the more familiar, but the unijunction is more stable and will be used in the oscillator. The output amplitude is determined by the device characteristics, not by the frequency-determining R and C. The frequency is easily and smoothly shifted if the charging resistance R is changed. The sawtooth output is easily smoothed into a sine wave by a low-pass filter.

Fig. 2 shows the circuit of an AFSK relaxation oscillator. The unijunction transistor is an inexpensive and stable solid-state equivalent of the neon bulb. Its operation is thoroughly covered in the *General Electric Transistor Manual* and will be described only briefly here.

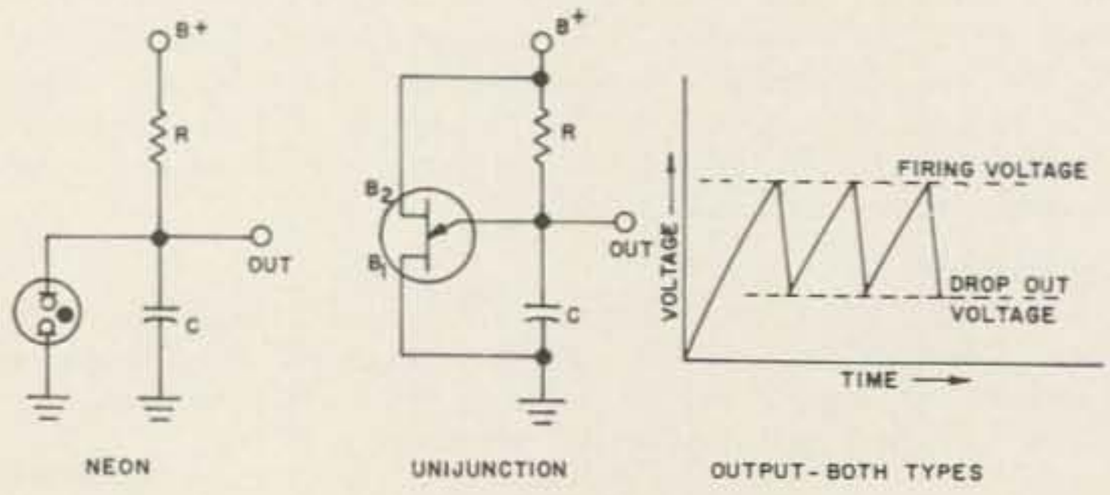


FIG. 1 RELAXATION OSCILLATORS

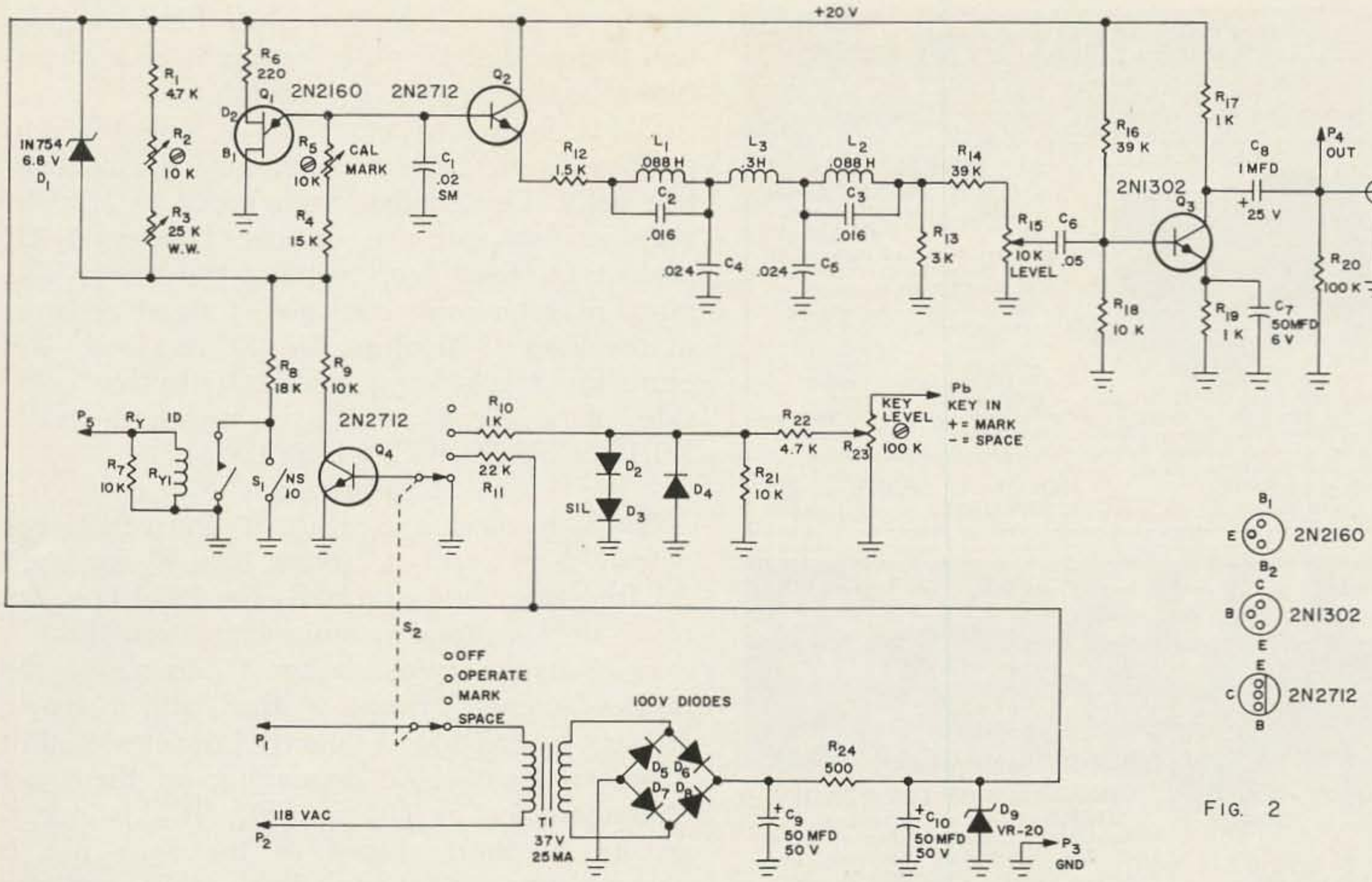


FIG. 2

Fig. 2. The novel AFSK oscillator. Connect bottom 3 terminals of bottom section of S_2 so that the oscillator will be on in operate, mark & space.

Operation

The unijunction is operated with + 20 volts on base two. The emitter is an open circuit for voltages below about 10 (varies with the transistor). As condenser C_1 charges through resistors R_1 through R_5, its voltage builds up to 10 v. At this voltage, the emitter to base-one junction breaks down, much as the gas in a neon bulb, and discharges C_1. This cycle repeats, producing the familiar sawtooth voltage across C_1. If the charging resistance is returned to the same voltage point as base two, the relaxation frequency is remarkably independent of voltage and temperature variations.

The generated sawtooth voltage is isolated by emitter-follower Q_2 and fed into a low-pass filter. As seen in Fig. 3, the filter cuts off above the *space* frequency (2975 cps) and is almost 40 db down for all harmonics of both the *mark* and *space* frequencies. The output waveform is a very good sine. The input resistor, R_{12}, can be set so that the output voltage varies less than ½ db over the range of 2125-2975 cps.

Inductors L_1 and L_2 are the familiar telephone loading toroids. L_3 is a toroid removed from a surplus filter. Condensers C_2-C_5 should be low loss units such as mica or polystyrene, selected for proper value on a bridge.

After filtering, the tones are amplified by Q_3. R_{14} is set to prevent overloading of Q_3 at maximum level.

Keying is accomplished by saturating (mark) or cutting off (space) transistor Q_4. With Q_4 cut off, Q_1 oscillates at a *space* frequency determined by the sum of R_1 through R_5. Diode D_1 does not conduct. With Q_4 saturated, R_9 causes D_1 to conduct at a constant 6.8 volts regardless of the setting of the shift pot R_3, and Q_1 now oscillates at a *mark* frequently determined only by R_4 plus R_5. The shift is adjustable from 100 cps minimum to 850 cps maximum by rotating a potentiometer, but the *mark* frequency is held at 2125

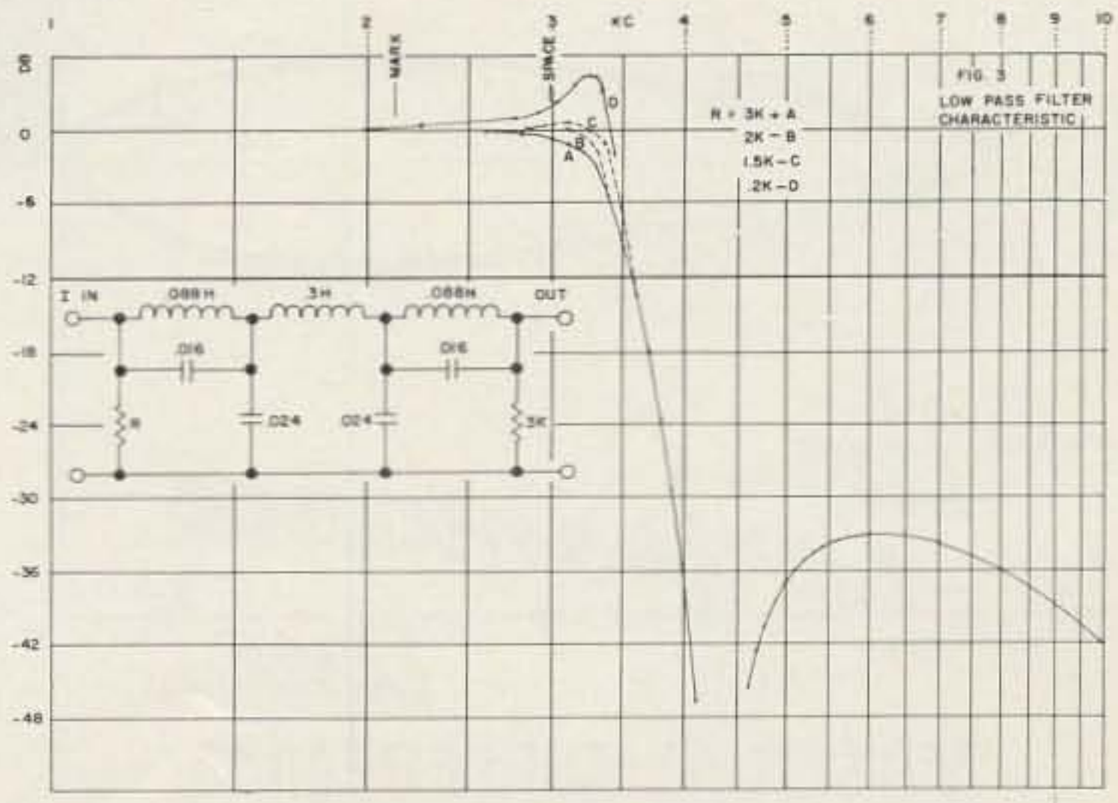
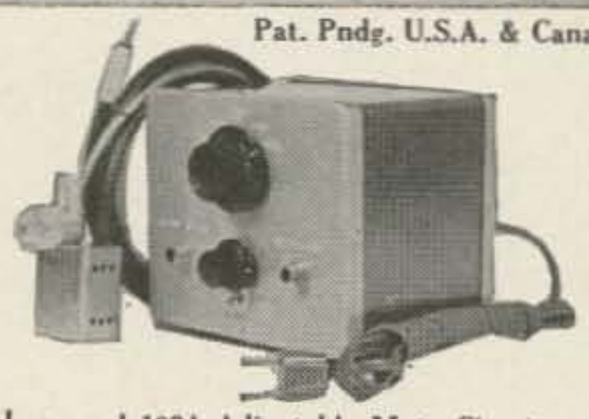


FIG. 3

TRANSTENNA 102A

A PRESELECTOR SECOND TO NONE AND A T-R SWITCH BEYOND COMPARISON



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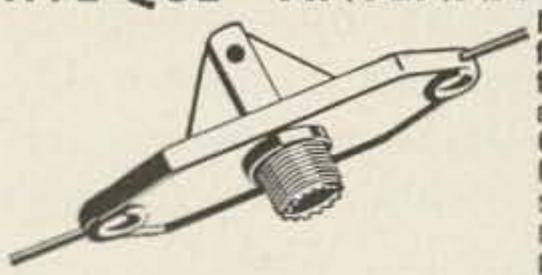

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cps by diode D_1. Narrow shift for identification is provided by push switch S_1 or a miniature relay for remote ID switching.

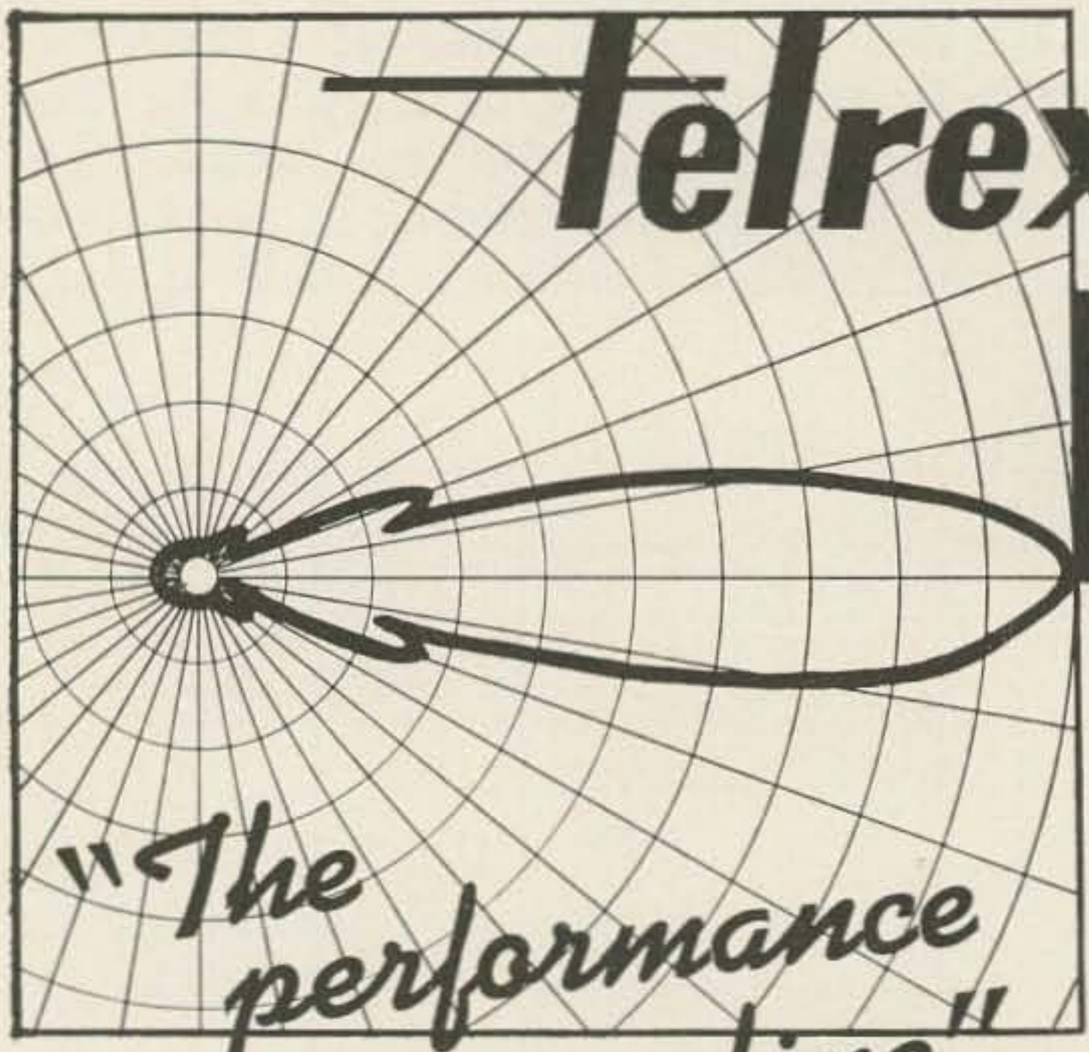
Q_4 is keyed to *mark* by a one-milliamp positive input current from any source over five volts. The change from *space* to *mark* is very sudden and non critical. Diodes D_2-D_4 protect Q_4 from loop voltage transients. The input may be connected across shunt resistors in the loop (100 ohms for 60 ma. loop; 300 ohms for 20 ma. loop) or directly to the "cold" side of a positive voltage keyboard as in K6IBE's TU-D (RTTY June 1963).

Calibration

Set S_2 to *mark* and adjust R_5 for a 2125 cps output. Now set S_2 to *space*, turn R_3 for highest frequency and adjust R_2 for 2975 cps. Because of variations in unijunction transistors it may be necessary to change C_1 to obtain the proper frequency range. With S_2 still in *space*, R_3 may be calibrated directly in cycles of shift down to about 100, depending on the exact characteristics of Q_1 and D_1. R_{12} is selected for constant output as the shift pot is varied over its range. With the oscillator connected to the loop, increase R_{23} just passed the point where marking occurs. Now turn your two meter beam towards Ohio and call K8ERV like mad.

. . . K8ERV

Gus-see p. 4



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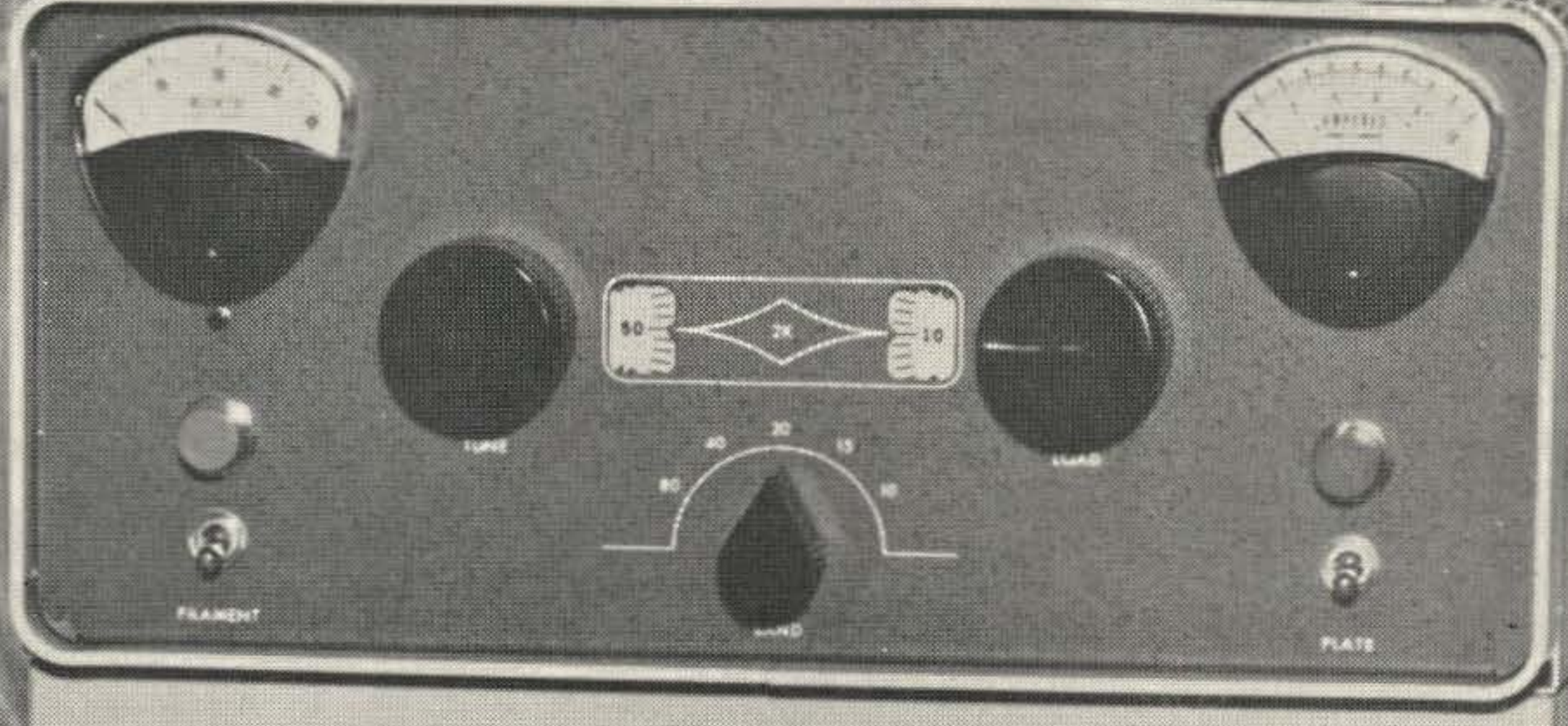

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How It's Done

It often takes several new ideas working together to make a new device. Don't forget, well-known A and B put together in a certain fashion, can make highly patentable C! As in the following example.

A. A miniaturized transistorized, crystal-controlled, modulated signal source small enough to fit inside a waveguide (or any rectangular cross section metal tubing of correct size).

B. Metal tubing as per above, whose dimensions are such as to present infinite cut-off for energy on the frequency involved, such as 144, 220, 432, 1215, or 1296 megacycles. The length of course must allow for the attenuation, which is very high per inch!

C. Metal end caps on the tubing, with a coaxial connector on one end, and a hole for a slide-handle or push rod with a graduated scale on the other.

And that's it. Infinite attenuators have been made before, of course, but usually have required also fantastic amounts of shielding, power lead bypassing, etc., for the oscillator. But this one just slides into the waveguide, signal source, power supply and all. As long as it sits well inside the guide, with no conducting metal of any kind coming out it works fine. This is totally important. I mounted one of these on a long piece of copper-clad bakelite which I figured to use also as a push-rod. The results? N.G.! The signal came right out on the copper.

If you want to switch it on and off from the outside you will have to use a rotary switch and a wooden dowel extension.

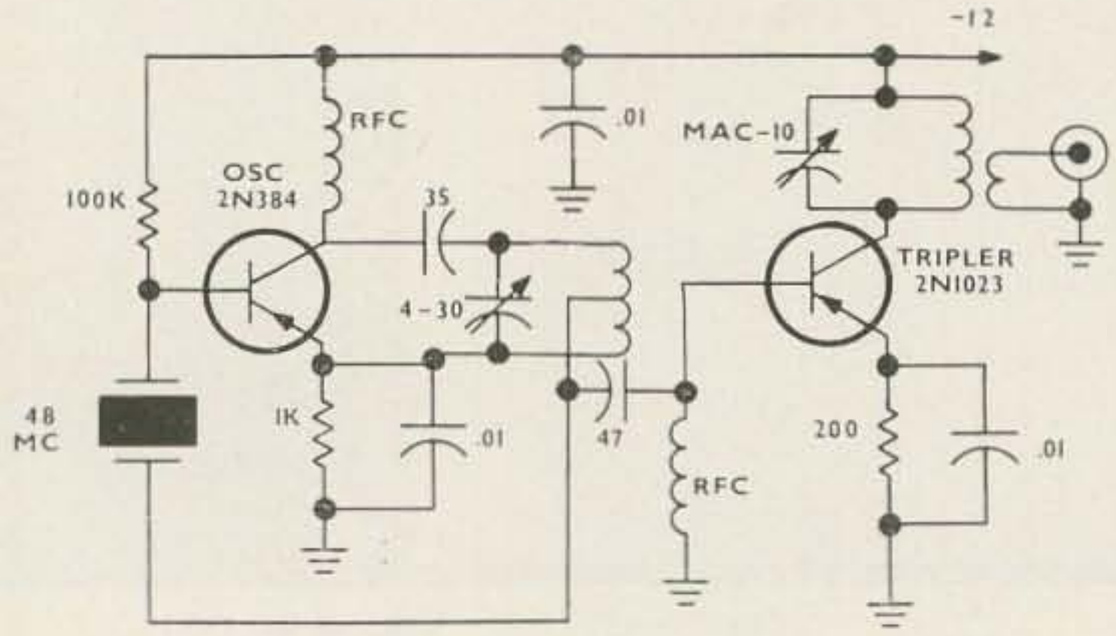

Fig. 1. 2 meter crystal controlled signal source. L1 is 7 turns airwound 16 tpi. Tap at 4 turns from cold end. L2 is 8 turns no. 16 copper airwound 3/16 inch id, 1 inch long. RFC is any good choke resonate below 48 mc.

Two Meter Signal Source

Fig. 1 shows this little unit which starts with a 48 megacycle crystal. The oscillator circuit is your present writer's favorite, the crystal phase reversing job. I have described this before, so this will be a shortie. If regenerative connections were used, that would put the emitter on the coil tap of L1, with the base on the end. Degenerative connections, as used, are the opposite, base tapped up on the coil, with the emitter on the end. However, due to the nature of piezo-electricity, the ac voltage on each end of a crystal is always 180 degrees out of phase, so, it not only oscillates but it will not take off anywhere ex-

cept on the crystal frequency. All other frequencies are highly degenerative.

The transistor used is a RCA 2N384. This type happens to be several years old but has always worked ok at 50 megacycles. It also saves my better units for 1296 where you really need the best.

The next one is a 2N1023, also RCA. This is a type that goes up past the 2 meter band. It also was on hand. Any good transistor honestly labelled UHF or even VHF should do all right in either of these positions. Incidentally, sockets are used. They work perfectly ok. Don't forget that germanium transistors should not really be soldered. With silicon units the manufacturer yells "What in the world are you using sockets for?" You can even solder right onto the case!

In spite of my oft-voiced preference for doubling, tripling is used here because it works adequately for the purpose: a good signal on 2 meters. There is much more signal than you need for sensitive receiver tests. In fact, you could use less battery voltage. I just tried it out, between these sentences, and find that 6 volts is as low as the unit described above will go. At that battery voltage the output is down to 20 microamperes as compared with 500 using a new 12 volt battery. As is however, it is nice for peaking antenna coils, rf stages alone, and on indoor antenna ranges. Outdoors too, if you use a receiver for one end of the range.

The tripler stage uses a 200 ohm emitter resistor and a grounded rf choke in the base with no dc excitation other than that furnished by rectification in the base-emitter circuit. The stage draws about one mil collector current while running.

A small copper-clad plate 2 × 1 inches is used to "launch" the signal into the waveguide. Again, there is more signal than needed for sensitive receivers. You could certainly omit the launching plate. An rf output jack allows maximum rf to be obtained for other test purposes. You can also use the unit as a local oscillator chain for a solid state two meter converter if you want to by changing the crystal and retuning a little. Use absorption frequency meters or a grid-dipper to do this. Better even use both!

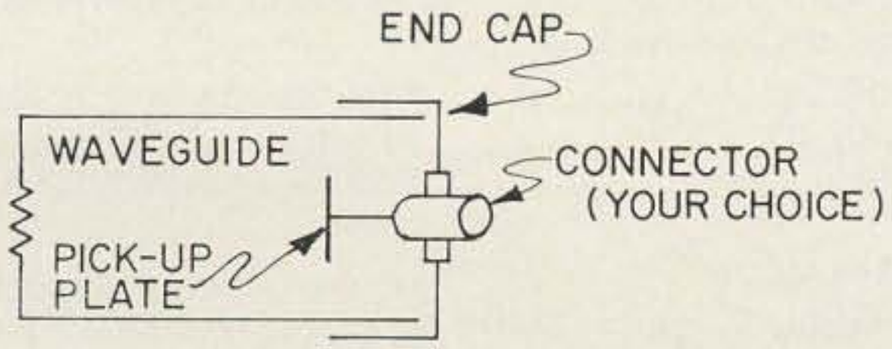

Fig. 2. Detail of pick-up end of attenuator

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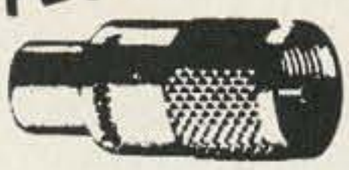

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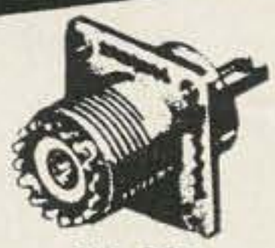

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Construction of the Attenuator

As you may have gathered, you can simply take a piece of aluminum waveguide or aluminum drainpipe about three inches wide and about two inches high, by some 4 feet long, tape the signal source to a 2 inch wide by 4 feet long strip of quarter inch plywood, and push it inside. You'll see immediately what happens to the signal if you are listening on your low noise superhet. When the source is well inside the guide, that signal will disappear!

Actually, a little work on the deal is quite rewarding. First an end cap, coax connector and "pick-up" plate, puts the signal right where you want it, that is, into the rf jack of your pre-amp.

Fig. 2 shows detail. The end cap can be formed of flashing copper, if you're good at making metal boxes. I'm not. The cap can be fastened on with tape or metal screws. Solder a small piece of copper clad bakelite to the coax connector, bakelite side in, and away you go.

The real nice feature of this is that instead of putting the signal out in the barn in a tin can, or over at your neighboring ham's shack, you now get all the signal you want, or as little as you want, right at the input jack of your receiver.

Believe me, for rf stages there is nothing like it. (Never mind the "government type" HP generators at $3,000 to $4,000 a throw. How much money do you think I get for writing ham articles?)

At the other end of the waveguide you need another end cap, with a hole in it for the "push-rod" handle. I fastened the copper clad base plate of the generator to a piece of thin plastic and then attached a ½ by ¾ inch strip of wood 4 feet long. As seen in the photo this comes out the end, and can be used for calibration purposes. I'll leave fancy stuff to you, such as remote control switch, (use wood or bakelite) modulator switch, etc. Just remember, no metal of any kind. The ground plane base of the generator has plenty of signal on it.

Results

I checked out the various detectors, receivers and converters I have to see their relative sensitivities in "inches" of push-rod sticking out.

Now I can really find out about the absolute signal sensitivities of the following units around the shack. A. Crystal mixer, including noise comparison of all my crystals; B. 6AM4 rf stage; C. Ditto 6AN4; D. New 2,000 megacycle type transistor stage (at 432 of course); E. The half dozen 416B's that have been knocking around the shack for some years; F. My 417A's; G. Anything else I can think of, such as noise reduction by neutralizing.

Using modulation on the generator, a simple absolute reference check can be made by using a scope on the receiver af output. Sync lock provides an exact reference level that is better than the human ear. Af wave on the scope versus "grass" of the noise can be used also. Signal level is varied by moving the push rod in and out of the waveguide. There is no use arguing with that set up! The complete receiver that locks on with the greatest distance is it! Don't change the af set-up while testing rf, of course. Voice recognition is another whole story yet.

Please excuse my not showing 220 megacycle units. It's just that I like to jump to 432. Then of course, you have to jump to 1215 or 1296. 220 should be easy, just put in another crystal and coils.

So that's all for now, yours for better noise figures.

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The Converted Converter

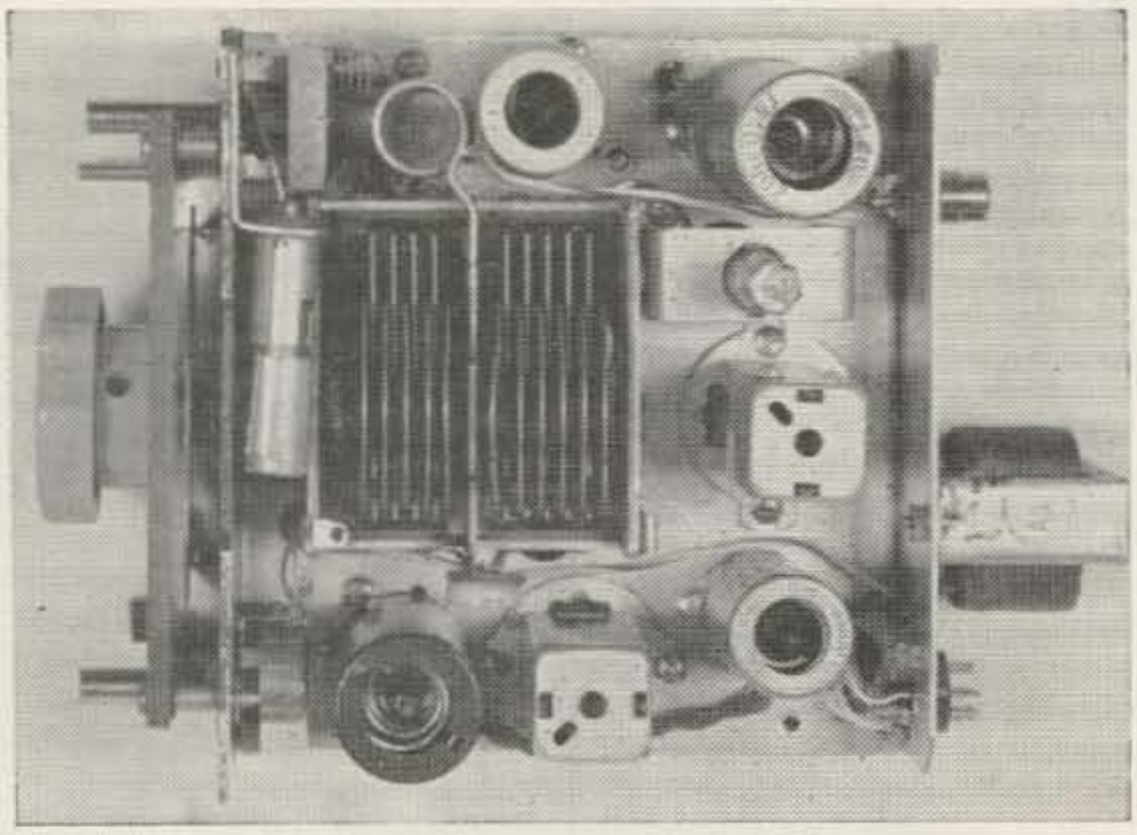
Turn a Gonset Tribander
into a complete receiver.

There have been many articles on conversion of surplus equipment and a few on conversion of old commercial equipment. Here we present a conversion of a converter. I picked up my old Gonset Tribander one evening and wondered what could be done in the way of making a receiver out of it. Out came the paper, slide rule, and coffee pot. I started figuring gains, bandpass circuits, tracking, and etc.; and came up with this little gem. This article is an attempt to show what can be done with one of these converters after a few evenings at the work bench. This little package, requiring only a power supply and speaker to be complete, can hear anything on ten meters that my 75A-4 can hear. This is where the comparison ends however, but in 10 meter mobile, you need little else.

The Gonset Tribander with its four tubes, when installed in the family chariot, required six or eight tubes in the BC set plus two more for the noise limiter. That is a lot of tubes and power, especially if you are interested primarily in one band. *This* receiver requires only 150v to 175v at 50 ma and 12v at 1 amp. The circuit in Fig. 2 may be used to power the receiver from the 110v line, and the circuit in Fig. 3 may be used in the car.

The receiver circuitry is simplicity itself. The tribander was used because I had one on the shelf but any of the Gonset converters will do just as well. Only the dial, tuning capacitor, rf coil (10 m), oscillator components, and the "screw in the upper left hand corner" were used. The entire chassis is stripped including tube sockets.

Fig. 1 will show the circuit is quite conventional, consisting of a 6GM6 rf stage, a 6EA8 pentode mixer with the triode section as the local oscillator. The *if* amplifier is an



Top view of Converted Converter receiver

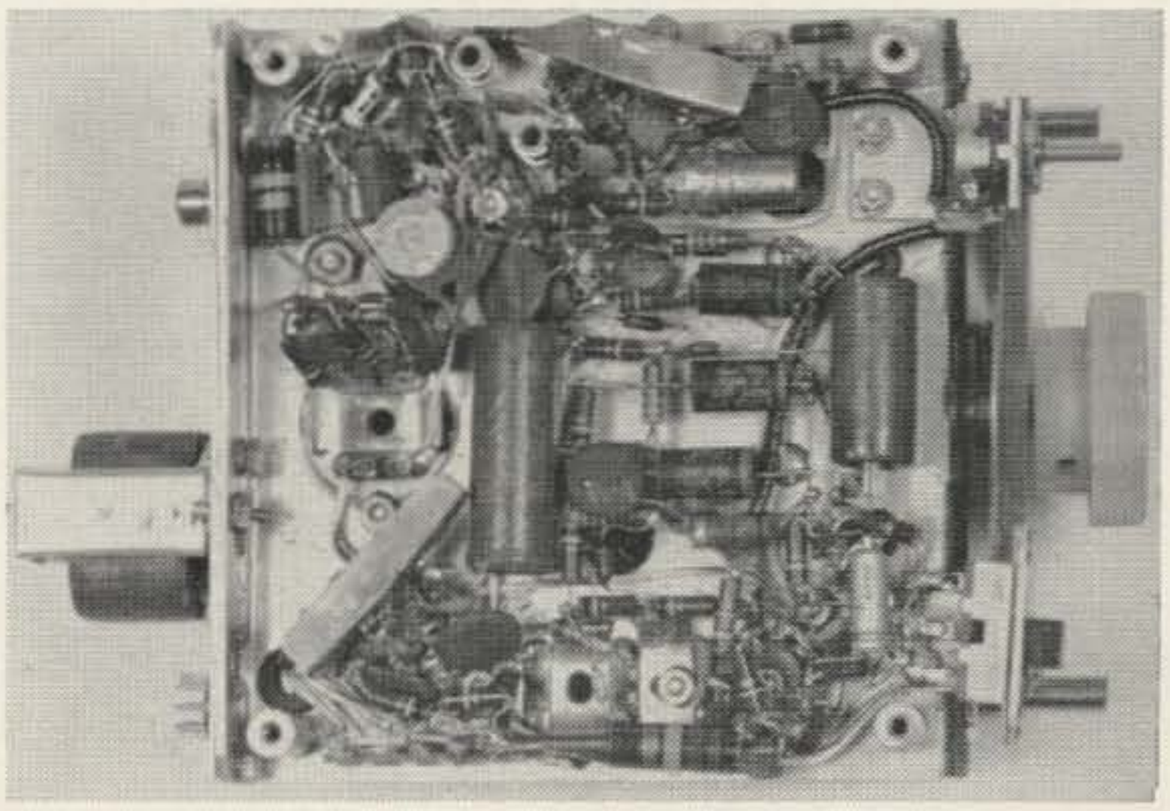
other 6GM6. The intermediate frequency of 1430 kc was retained in order to preserve the original dial calibrations and tracking. As you may probably guess, the secret of the phenomenal sensitivity of this receiver is obtained by using high gain tubes in the first three stages. The 6GM6 has a transconductance of 13,000 μmhos and the 6EA8 pentode has a conversion gm of about 4,000 μmhos. This, coupled with a high Q input circuit, results in a lot of gain with a few tubes. After the detector is a silicon diode rate of change noise limiter, followed by a 6EB8 first audio and power out-put stage.

The original antenna coil is mounted on the variable capacitor (front section) next to the antenna trimmer. The ground end is soldered to the top of the capacitor frame and the antenna tap is one turn down. Once the antenna trimmer is tuned for maximum in the center of the band, the main tuning will track over the entire band.

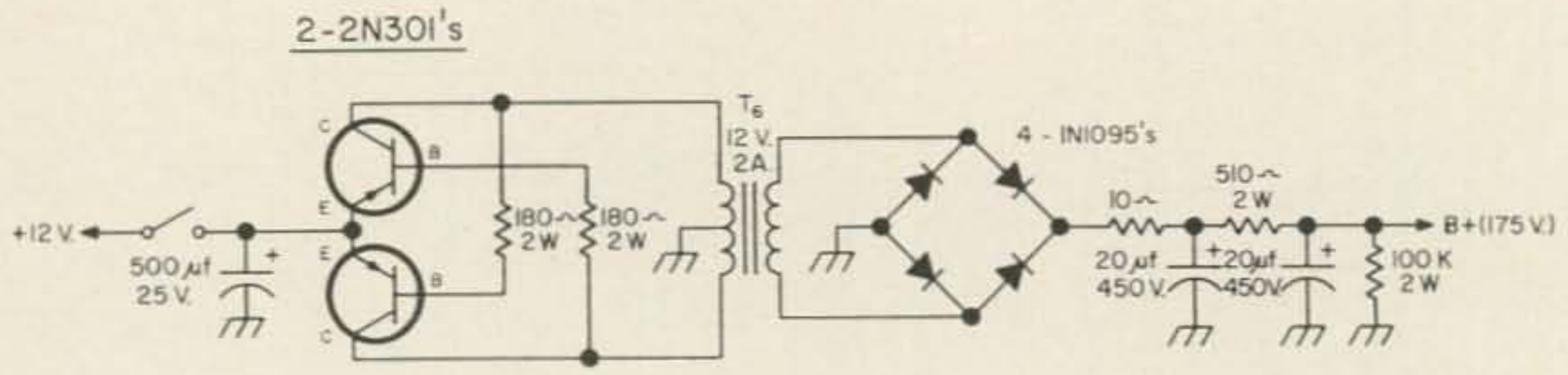
Note the absence of cathode resistors in the first three stages. The bias for all three stages is made up by their respective grid resistors. The values are large enough to provide the proper bias by contact potential.

The plate of the rf amplifier is a double tuned broad band circuit. One coil is peaked at 29.2 Mc and the other at 28.8 Mc. The coils may be purchased already wound but if you have a couple forms of this size, coil winding data is given. The coils should be mounted about ¾" apart.

As mentioned earlier, the original oscillator components are used. They must be carefully removed if they are to be used. I re-



Bottom view of receiver



12 vdc power supply

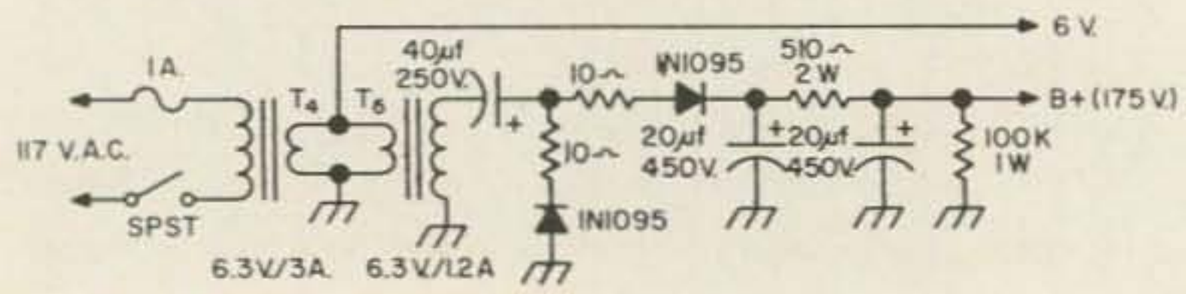
placed the 82 pf and 100 pf negative temp. capacitors with silver micas; however, I retained the 2 pf oscillator injection capacitor. An added refinement is the 1N1797-130V Zener diode to voltage stabilize the oscillator. This may be left out, or a VR105 may be added in the power supply. A band set trimmer is mounted on the variable capacitor frame next to the 6EB8.

The variable capacitor will tune over a much wider range than we need, so a band edge stop must be installed. This may easily be done by removing the dial plate from the main shaft and replacing the set screw with a ½" 4-40 bolt. The bolt will stop at each end of the band on the shaft of the tuning capacitor. Take care to replace the dial in the same place as it was or you will upset the tracking. One last point in the oscillator section; don't forget the 2 pf oscillator injection capacitor to the mixer. I did, and spent several days trying to find out why the receiver was so insensitive.

The mixer is a relatively new tube and is straight-forward circuitry. There is a new bottle out by RCA I will try sometime in the near future in this circuit. It is a 6KE8 triode and frame grid pentode. The gm of the pentode is 12,000 μmhos and is designed for high gain mixer circuits. The *if* amplifier (only one) is conventional.

Now we come to the noise limiter and squelch circuit. The noise limiter is the Rate of Change circuit that appeared in Dec. 1962 of 73. Note that the two input resistors have been increased to 100 k. This gave me more output and a greater degree of noise suppression. I make no claims that this is an improvement, only that it's different.

The squelch is nothing more than a diode switch. It lets the audio through when conducting and cuts it off when its non-conducting.



AC power supply

I could go on about this circuit but K4UWX described it at great length in his article "Simple Squelch" in Nov. '62 of this magazine.

The 6EB8 in the audio stage takes the place of the usual 6AQ5-12AX7 combination in that it combines power amplifier and voltage amplifier in one bottle. The receiver didn't have quite enough gain in the audio section so a 7895 nuvistor was added for more gain. As you can see in the photograph, it is mounted under the chassis up next to the rf stage.

The input connector is an amphenal miniature "CP" series 7 pin plug mounted in a tube socket ring. The tube socket became the female cable connector. It makes a very small multi contact connector.

The slide switch on the front panel switches the 12v to the filaments and to the output connector to energize a relay in the power supply. The other half of the switch connects the car speaker either to the receiver or to the bc set. Incidentally, if anybody is partial to the TNS noise limiter and squelch there is plenty of room under the chassis if you use a pair of silicon diodes and a pair of 6CW4 nuvistors.

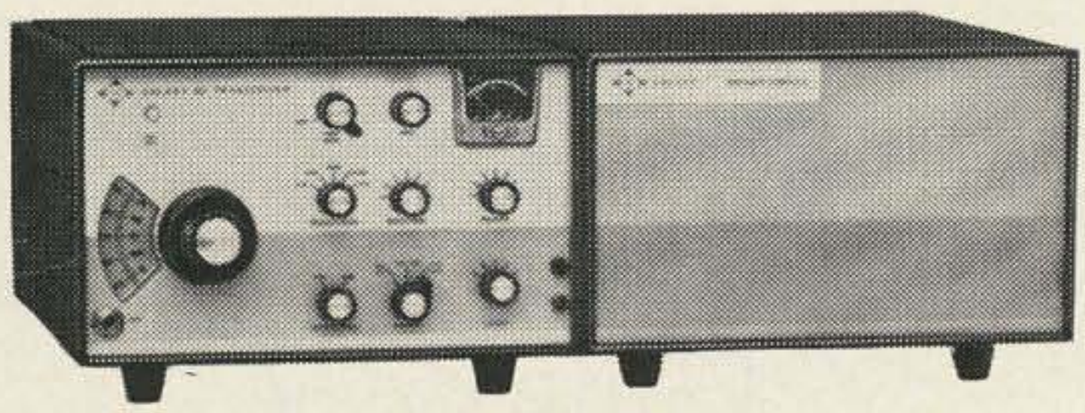
This receiver has performed trouble free for about 6 months and is still going strong. A matching transmitter with vfo, screen modulator, and a power input of 100w is under construction in another converter case.

. . . W3ZFJ

Parts List

L1 original antenna coil, antenna tap 1 turn
L2, L3 12T #30 wire on 3/16" ceramic iron slug form, spaced ¾" apart. or Miller 4300 form or 4306 coils may be used.
L4 original oscillator coil
D1 1N1797 Zener Diode
D2, D3 Texas Inst. 1N486 or Hughes 1N426 silicon diodes
T1 10K to 4 ohms output transformer. Stancor A-3879
T2 Miller 13-W1 1500kc if trans.
T3 Miller 13-W2 1500kc if trans.
T4 Thordarson 21F10
T5 Thordarson 21F09
T6 Thordarson 26F67

Have you checked these out yet?



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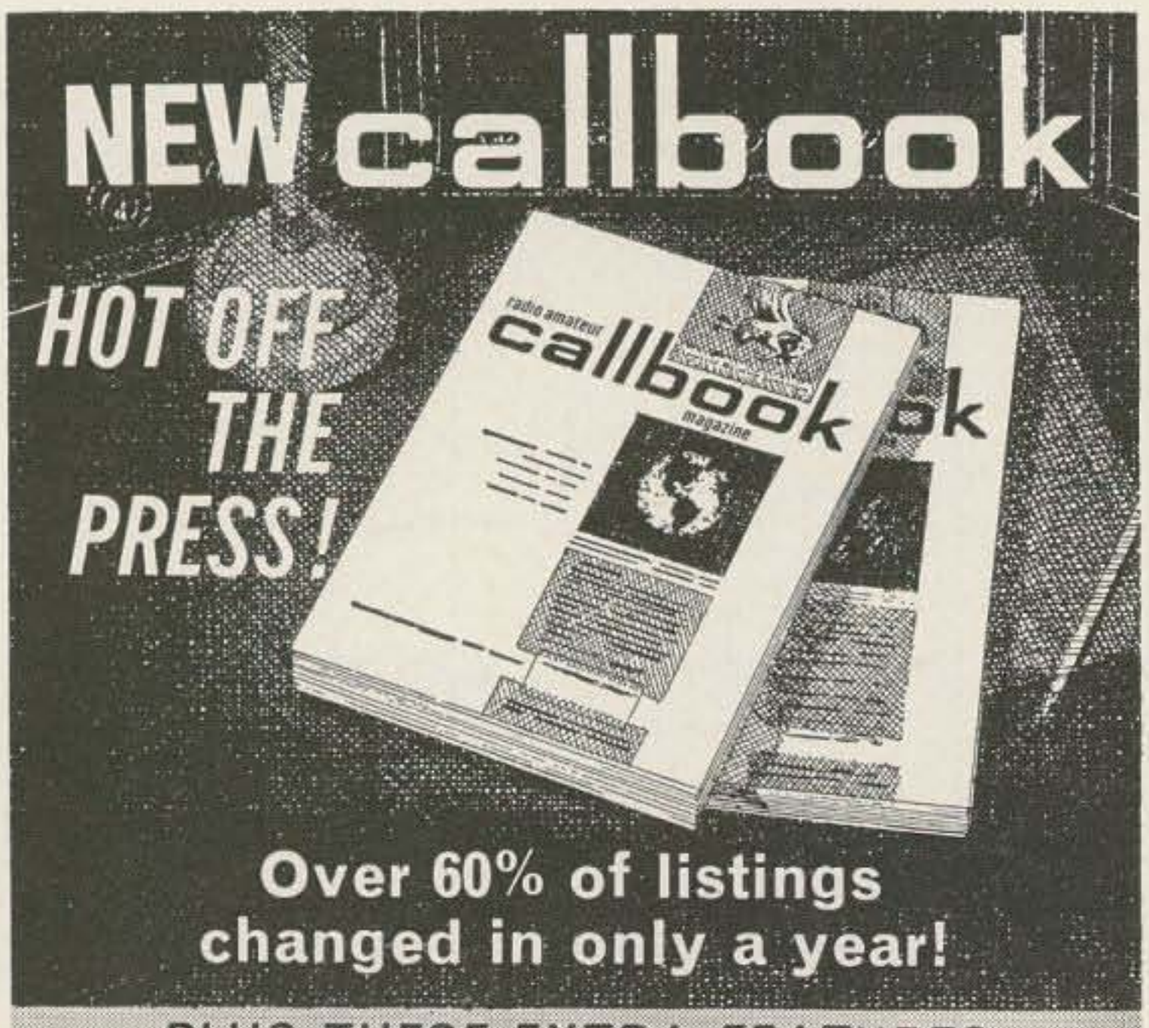

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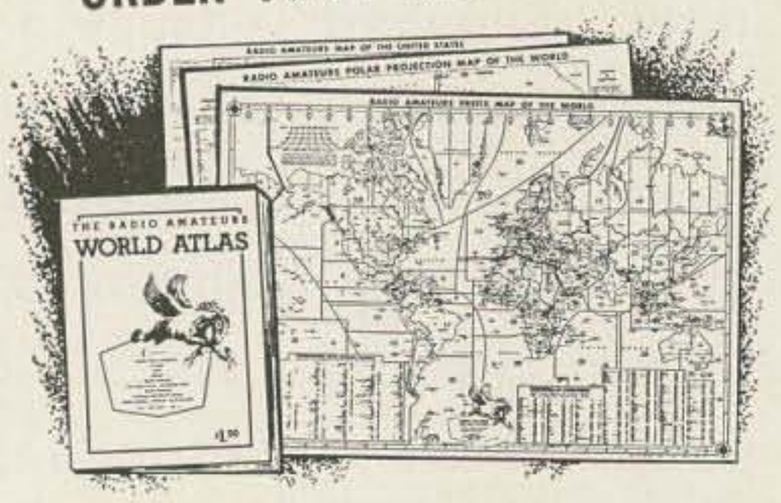

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73 Tests the Galaxy V

It's driving me out of my mind. The V arrived just a few days ago on loan for evaluation. I was quite surprised at how small it was . . . it looked so big in the ads. Instead of setting it up down in the ham shack I decided to put it on a small typewriter table by my desk and feed the antenna up through the floor.

Frankly, since the Galaxy V is the lowest cost five band selectable sideband transceiver, I expected to be faced with all kinds of miseries in operation. Not a problem of any sort has turned up.

My first try was on 3999 kc, probably the most aristocratic frequency of all the hambands. After a careful examination of my signal on their scopes I was admitted to this elite group and permitted to talk freely with the assembled M-2's. Had there been untoward carrier, unwanted sideband, or distortion I never would have made the club.

That night I tuned up on twenty meters . . . Oh, by the way, the V is a snap to tune . . . even old fumble-fingers me got the hang of it right off. My first call was YV5CEI. When we finished I got trapped by two fellows down Boston way . . . 73 readers . . . and I got another hour behind on my work. This having a rig by the desk is bad news . . . it is too easy to flip it on just to see who is there . . . then I *have* to call in and say hello to some old friend. Yes, I do have some friends.

One control that is left off some of the transceivers is the one for switching sidebands. Sure, you don't need it often, but when you do you do. One of the first stations I heard on 75 was using the upper sideband instead of lower and I switched him in with a chuckle to myself, thinking of all the fellows who could hear the noise, but couldn't tune it in. Obviously this is quite advantageous on CW, where at least one side of the station you are working has a little less QRM than the other.

This brings up another considerable advantage of the Galaxy V . . . CW. Many of the transceivers are designed strictly for SSB . . . some permit CW, but don't let you tune the entire CW part of the ham bands. The V covers not only the entire ham bands, but overlaps enough on most bands to permit MARS operation, reception of CHU, and stuff like that. Specifically it tunes from 3.5-4.0 mc, 7.0-7.5 mc, 14.0-14.5 mc, 21.0-21.5 mc, 28.0-29.0 mc. Crystals are available to allow the V to tune other frequencies of course. CW ops will be glad to note that the rig runs 300 watts and that they've shifted the carrier 1 kc into the passband to eliminate "leap-frogging."

Galaxy uses transistors for the audio amplifier, driver and output circuits and in the accessory vox plug-in unit. Not caring for vox myself, I am glad to find it now is optional. The transistors considerably cut down on the size of the unit; good move.

Though I've been conditioned to rely on Galaxy's advertised specs, I still wanted to see if this little black box could really put out 200 watts into my dummy load the way they said it could. In the CW position my Waters Dummy (no offense) Load Wattmeter read 200 watts right on the nose. The wattmeter doesn't read PEP watts (whose does?), but if it will put *out* 200 CW watts I guess it doesn't have any problem mustering up the 300 SSB watts input they claim.

Perhaps it isn't even necessary to bring this up, but the Galaxy V is every bit as stable as you could ask. I only mention this because I've gotten tired retuning the fellows I'm talking with after each transmission on another make transceiver that I've been using. That one is not in current production, so don't worry about it. The Galaxy V, even when freshly turned on, stays right on frequency. Good show.

. . . W2NSD/1

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Same less tubes and Dynamotor DN9 . . . . . FAIR 9.75
T465/ALT7 Xmittr 168-352mc W/2-6161s, 100W out EX 22.50
Schematic for T465/ALT7 with parts values 1.00
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SA325/U Coaxial Relay SP4T W/28 VDC Motor . . EX 2.75
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Set of 120 Xtals Type FT243 5675 thru 8650 kc in 25 kc increments. US tested and packed 120/17.50
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RE2/ARC5 Ant Relay W/Meter & Vacuum Capacitor EX 1.85
C45 Control Box for ARC1 and ARC12 Xceivers . GOOD 1.35
C732/ARC2 Control Box for ARC2 Xceiver . . . . . GOOD 1.85
MT7A Mounting for one AR5 receiver . . . . . EX 1.50
Meter Weston Model 843 500-0-500 microamps. 3" EX 3.85
Selenium Rectifier, 28VDC @ 4A, full wave . . . . NEW 3/3.75
IC/VRW7 Wire Recorder 28 VDC W/Tubes . . . GOOD 4.50
R122A/ARN12 75 mc Superhet w/tubes & xtal . . EX 3.85
UPM11A AFC chassis w/8 tubes & wiring diagram NEW 3.75

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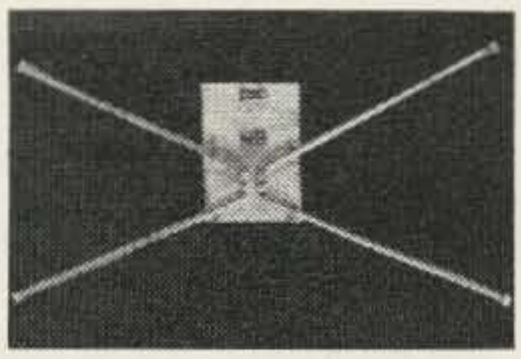
2 METER (almost) NON-DIRECTIONAL ANTENNA



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A rugged antenna for 2 meters that will give more gain and better coverage than a dipole. The Con-ex will withstand gales in excess of 100 mph. Perfect for local nets. An antenna every VHF ham can afford and should have for local contacts. Mounts for either vertical or horizontal polarizations.

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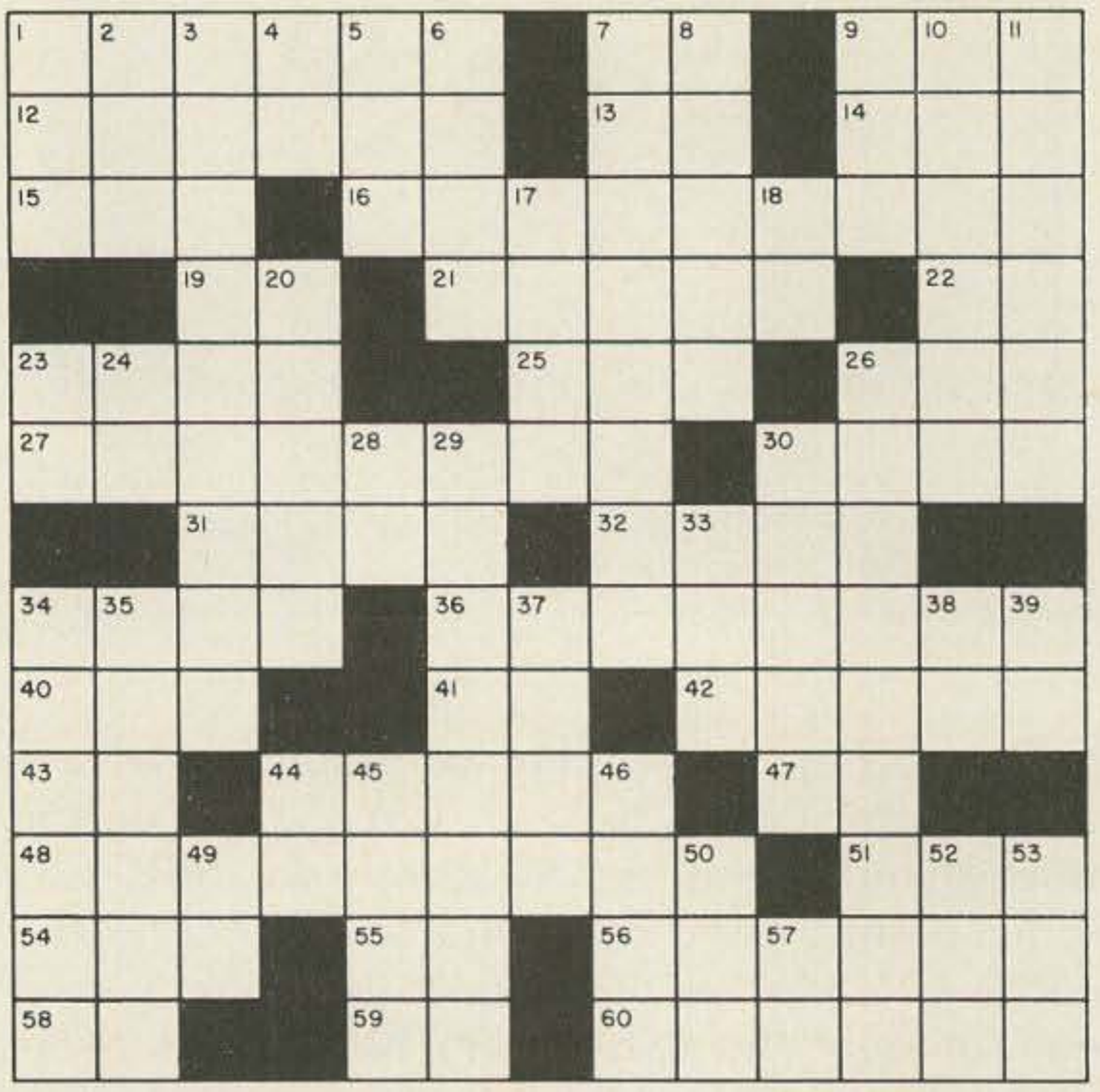

Max Winter K2PIJ
2444 Barker Avenue
New York 67, New York

Across:

1. Colored thread used in wire insulation to aid in identification
7. Abbreviation for radio bands at a higher frequency than broadcast
9. Classified notices
12. Vacuum tube having a specified number of electrons
13. Greek letter having many electronic applications
14. Type of coil winding
15. A square of butter
16. Clipping circuit in TV receivers
19. The: (Spanish)
21. Challenges
22. Marine officer (abbr.)
23. ———— fide
25. Periods of time (abbr.)
26. One side of a ship
27. Slang for microwave coax circuit
30. Physics term concerned with weight and acceleration
31. Mimic
32. Interjection
34. Reclines
36. Rhetorical comparison of negative and positive
40. Numerical value of brown
41. Continent (abbr.)
42. Speaker parts
43. Symbol for cerium
44. Adjust the beam in a cathode-ray tube
47. Continent (abbr.)
48. Units of electromotive force
51. Golfing equipment
54. University degree
55. Symbol for erbium
58. Symbol for tellurium
59. Compass direction
60. Wheatstone circuit used to measure impedance.

Down:

1. Portion of a hill best suited for microwave tower
2. Prominent electronic manufacturer
3. Reduce the strength of an electrical impulse
4. Symbol for cobalt
5. 5Man's name (plural)
6. Type of frequency meter
7. Arrangement of two electrodes used in early type transmitters
8. Paths for electric current
9. Liable
10. Type of tubes
11. Method of arranging circuit parts
17. Chess piece
18. Like
20. Sources of electric illumination
23. Temperature constant for a liquid
24. Electrical protective device (abbr.)
26. Type of iron core
28. Metal winding in some types of geiger tubes (abbr.)
29. Type of transformer
30. Sub-atomic particle
33. Chemical elements in hydrocarbons
34. Mounting device for tubes
35. Interior
37. Man's name
38. Symbol for tellurium
39. ——Q: abbreviation for Mister
44. British State Department (abbr.)
45. Heated enclosure for a quartz crystal
46. Open impedance path between two conductors
49. Unit of weight (abbr.)
50. Spanish for Mr.
52. Electronics expert (abbr.)
53. Summer: French
57. Symbol for bismuth

Solution on p. 90

Giant Inventory Reduction Sale!
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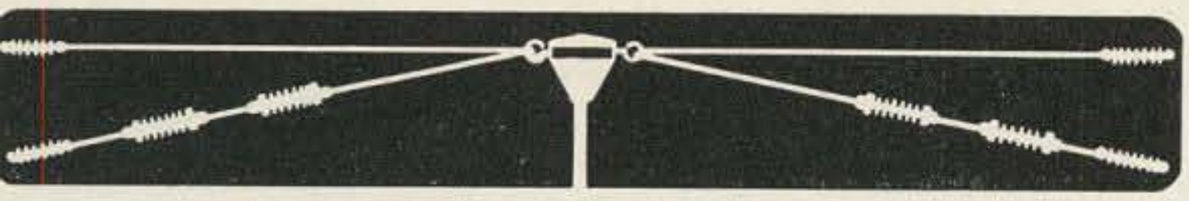
First come, first served -- Quantities limited

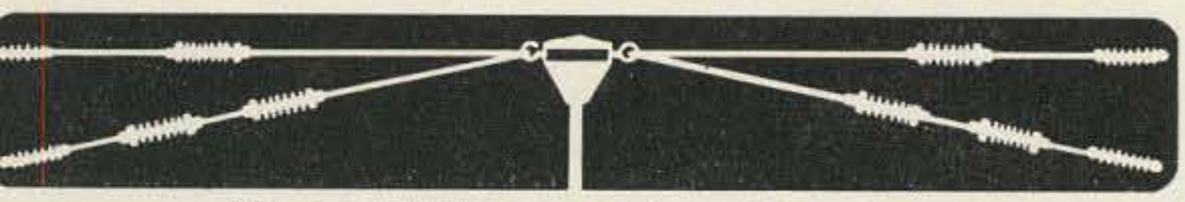
hy-gain MULTIBAND DOUBLETS

Complete multiband doublet antenna systems featuring Hy-Gain solid state traps for each band...copper clad stranded steel wire...high impact cycolac center and end insulators...52 ohm coax feedline. Built to take unlimited power...withstand winds up to 100 mph.

Model 2BDT for 40 and 80 meters
Reg. $19.95 HCJ Close-out $14.50



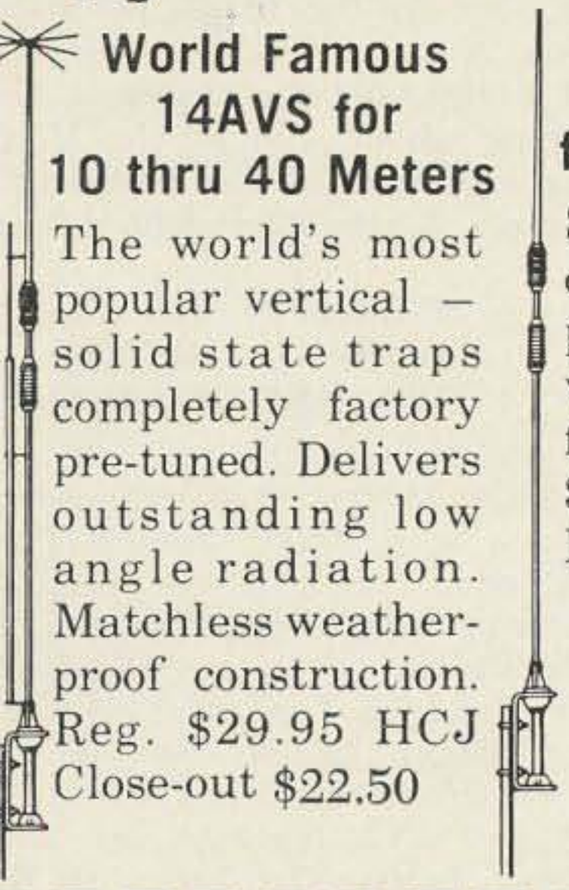
Model 4BDT for 10 thru 40 meters
Reg. $24.50 HCJ Close-out $17.50



Model 5BDT for 10 thru 80 meters
Reg. $34.95 HCJ Close-out $24.50

40 & 80 Meter Trap Kit — Model 2TD
Two factory tuned solid state, slim line traps with hardware for attachment to antenna wire.
Reg. $12.95 HCJ Close-out $9.00

hy-gain MULTIBAND VERTICALS



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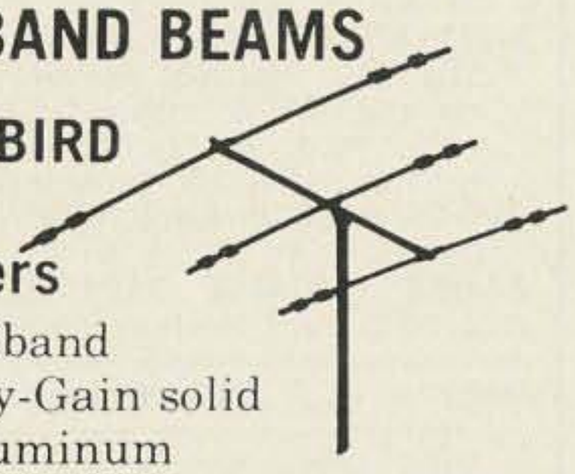
The 12AVS for 10, 15 & 20 Meters

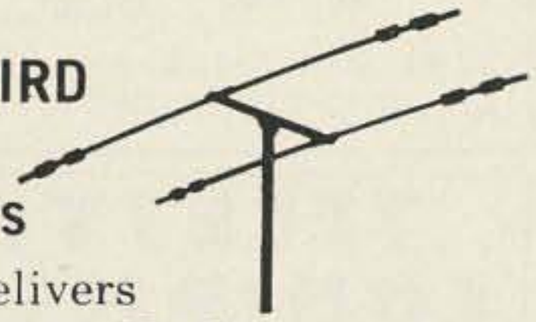
Self-supporting trap vertical for 10-20 meters. Completely factory pre-tuned with SWR 2:1 or less. 13.5 ft. overall height. Reg. $21.95
HCJ Close-out $16.50

hy-gain MULTIBAND BEAMS



Model TH3 THUNDERBIRD 3-Element Tribander for 10, 15 & 20 Meters

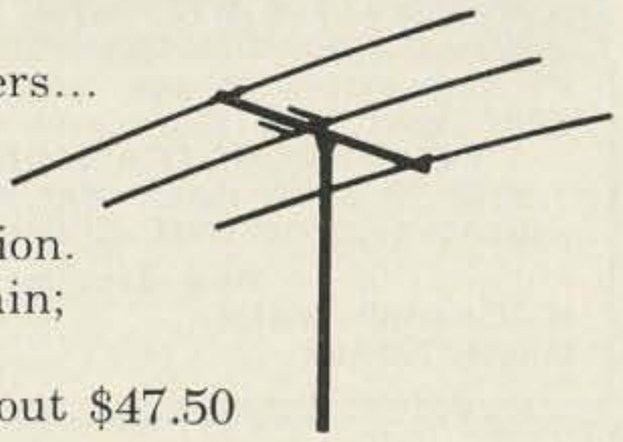
A high performance multiband beam featuring famous Hy-Gain solid state traps. Rugged all aluminum construction. Completely factory pre-tuned. SWR less than 2:1. Reg. $99.75 HCJ Close-out **$75.00**



Model TH2 THUNDERBIRD 2-Element Tribander for 10, 15 & 20 Meters

Compact, easy to install. Delivers excellent performance. Features Hy-Gain solid state traps and rugged all aluminum construction. Rotates with TV rotator.
Reg. $69.95 HCJ Close-out $50.00

3-Element 20 Meter Monoband Beam Model 203B



A real bomb on 20 meters... featuring full-sized spacing and heavy duty all aluminum construction. Delivers 8db forward gain; 25db F/B ratio.
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CARBON COMPRESSION RHEOSTAT—1500W, 0.01 to 2 ohms. 56 carbon plates 3″ x 3″. Brand New. **$24.95**

T-271/ART-28 RADAR RELAY TRANSMITTER—Tuneable 460-510 MC. Xlnt for Ham-TV. Has two 4X150A final, with air sockets & axivane blower; 3E29 sync. mod, 6L6W video mod. & 11 other tubes, **two panel meters**, four ten turn dials & Schematic. Xlnt. **$45.95**

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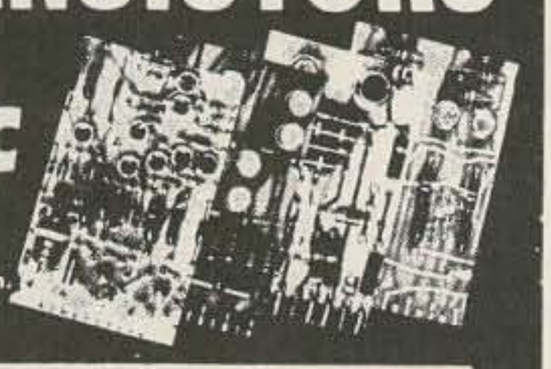

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SEND YOUR ORDERS TO **ALCO** LAWRENCE, MASS.

Letters

(Continued from page 65)

Dear OM,

Yesterday, when I returned home from the University of Iowa, I grabbed up the waiting March issue of "73"—a real bombshell. I was really surprised to see the first column and a half in the "de W2NSD/1" dept. devoted to "flying sorcerers." Apparently you have become interested enough to dig beneath a veneer of government smoke-screening and crackpot factions. Welcome to one of the biggest mysteries of the twentieth century.

The implications of the presence within our atmosphere of these strange, unknown objects are overwhelming if you have the courage to really think about it. And there is abundant and continually accumulating evidence that the objects are real, made by and controlled by intelligence, and that they do not originate on this planet; this regardless of what the Pentagon people preach.

Sooner or later, the populace has to find out, and the longer the government keeps playing games with the public, the worse it's going to be when finally it gets too big for the Pentagon boys to sit on.

Just in case you get more response on the saucers than on RM-499, and are stuck for references to reliable data on UFOs, may I suggest the National Investigations Committee on Aerial Phenomena, 1536 Connecticut Ave., N.W., Washington 36, D. C.? Perhaps you have heard NIAP, a private member supported organization, mentioned in some of your serious discussions about UFOs.

As you blaze away in the pages of "73" against the woes that beset the present and future of amateur radio, so has NICAP been crusading for recognition of the reality and the significance to humanity of the UFOs. NICAP has been plugging away for over eight years despite the government clamp down of significant data, and various attempts to discredit the group. Now things are beginning to pay off, especially with the current height of UFO activity in this country. The activity promises to exceed the much publicized saucer "flaps" of the early & mid 1950s, although the lack of news coverage wouldn't indicate this. And the Washington sightings are starting the new year off with a bang, as you well know.

NICAP is international in scope, with over 5,000 members, of which I am one. The group is non-political, non-profit; NICAP is dedicated to the belief that there is something going on in our skies which we should all know more about, MUCH more about. If you are interested in following the current situation, I suggest you join NICAP, or at least get a copy of their 1964 publication, "The UFO Evidence." It is an outstanding contribution in factual reporting, and is the result of years of investigation and evaluation of myraid UFO cases. I can pretty well guarantee that if you read the evidence, you will do some profound thinking about the whole UFO subject. Perhaps "73" will feel disposed to run a monthly column on the subject; "Green's Little Green Men," or something. Hi!

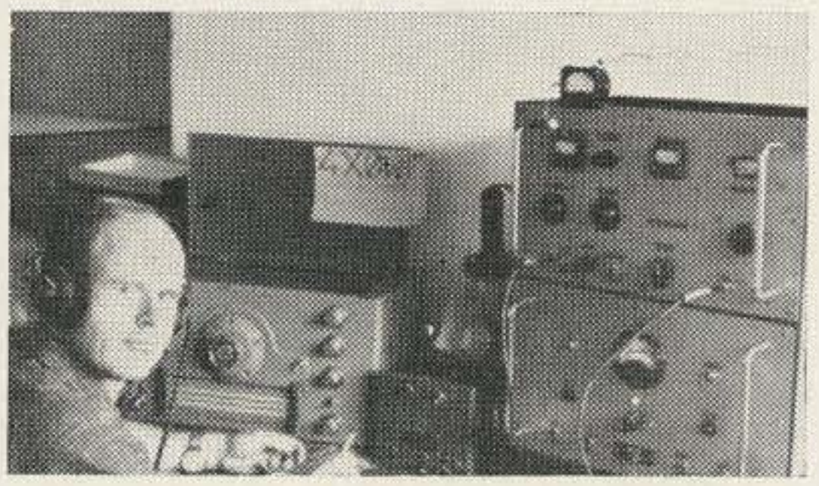
William H. Hunkins
IoAR NICAP
WA5EKQ/WAØKOM

Gentlemen:

DX-pedition may at times be an overworked expression, but I have one to report which is a "first" in the Post World War II Era from SP-land. Andre K. Krzysztofik SP5ALG took part in a DX-pedition from Poland via the Mediterranean to the Dead Sea area in 4X4-land. Andre SP5ALG left his native land on June 9, 1964 with a home-brew 200-watt rig, a Drake 2B receiver and a long-wire 80-meter antenna. After visiting such countries as SM, OZ, DL, PAØ, CN8 and 7X2 (ex-FA), his first transmissions enroute were from Sousse Tunisia with the call sign 3V8GM. A few QSO's were with W stations out of mort then 200 contacts made from Tunisia. En-route from 3V8 land to Israel, he touched on countries such as OD5, YK, and JY. While in Israel he was granted permission to operate with the call sign SP5ALG/4X4WF.

Together with Dr. Eric Friedman 4X4WF ex-SP6WF, he operated a DX-pedition station from the Dead Sea area with the call sign 4XØWF. The prefix 4XØ was used for the first time in Israel. Andre and Eric operated

SP5ALG



4X4WF

4XØWF for 60 hours continuously on October 18, 19 and 20, 1964. Unfortunately, conditions were very poor during the time that station 4XØWF was in operation; otherwise many more contacts would have been made. U.S.A. stations were worked on the 7 and 3.5 megacycle bands. Due to the depression of the land, conditions to Europe and to North America were very poor. Except for very heavy QRM from U stations, conditions to Oceania and Asia were very fine business. The prefix 4XØ is new for WPX. This DX-pedition was a very interesting one from the standpoint of QTH because the Dead Sea is located 1200 feet below sea level.

A couple of days later, Andre obtained for a call sign 4X4UJ and made scores of contacts from the City of Haifa. Andre left Israel November 25, 1964 for the U.S.A. via such countries as I, EA, ZB2 and EA8. He now hopes to obtain operating privileges on the ham bands. This stems from the fact that the U.S.A. has entered into reciprocal agreements with countries which allow U.S. radio amateurs the privilege of operating in their respective countries. All QSL's will be answered 100%; these include all QSO's made with ex-SP5ALG, 3V8GM, SP5ALG/4X4WF, 4XØWF, and 4X4UJ. Please address all QSL's via W2VLS.

W2VLS

Improving the 4-Band KWM-1*

Dear Wayne:

The following improvements have been made to my expanded KWM-1 resulting in all controls being on the front panel and no frequency jump when switching sidebands.

Replace R-115, the anti-trip pot with a Centralab FI-0K. Use a matching Centralab shaft thru it to actuate the switch in the final compartment. If you did not align the two, use a flexible shaft coupling to connect them.

Replace R-92, the mike-gain pot, with a Centralap FI-00K and matching shaft similar to the anti-trip control. Replace the SPDT slide switch for switching sidebands with a DPDT switch same size and same place. Connect the center of the second pole to ground and connect the upper sideband contact to a 36 pf capacitor in parallel with a 4-12 pf trimmer. Connect the other end of the capacitor and trimmer to pin 7 of V-22.

Connect the slide switch actuator to the shaft thru R-22 with a piece of piano wire so that you can operate the switch. With a little bushing or some shim stock you can use the original knobs on the 3/16" shafts. I cut discs for the knobs for the concentric pots of 1/8" plexiglass. You can probably get some concentric TV knobs to fit.

When you are through, tune in the calibrate note and adjust the trimmer so that it is zero beat on both side bands.

* Four bands on the KWM-1' "73" Dec, 1963 pg. 60

Lou Weber K6GHU

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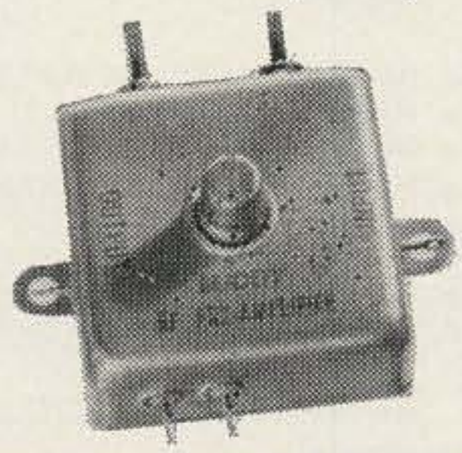

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Highest stability—negligible warm-up time.
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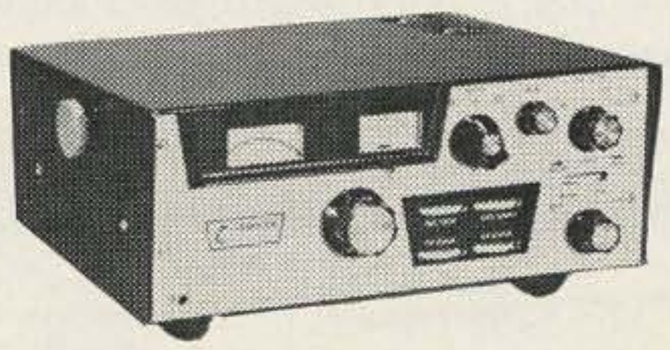

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SBD-3 mobile power supply: $99.50
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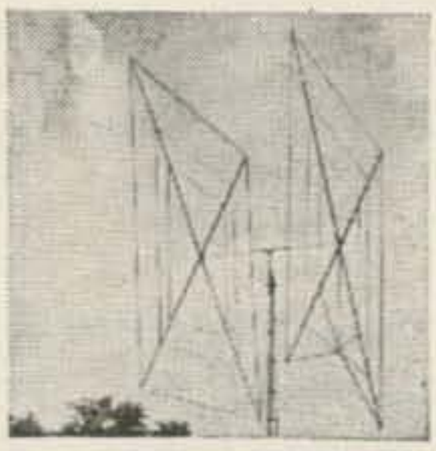

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Complete as shown total length 102 ft. with 96 ft. of 72 ohm balanced twinline. Hi-impact molded resonant traps. (Wt. 3 oz. 1" x 5" long). You just tune to desired band for beamlike results. Excellent for ALL world-wide short-wave receivers and amateur transmitters. For NOVICE AND ALL CLASS AMATEURS! NO EXTRA TUNERS OR GADGETS NEEDED! Eliminates 5 separate antennas with excellent performance guaranteed. Inconspicuous for Fussy Neighborhoods! NO HAYWIRE HOUSE APPEARANCE! EASY INSTALLATION! Complete Instructions.

75-40-20-15-10 meter bands. Complete $15.95

40-20-15-10 meter. 54-ft. (best for swl's) Complete ... $14.95

SEND ONLY $3.00 (cash, ck., mo) and pay postman balance COD plus postage on arrival or send full price for postpaid delivery. Complete installation & technical instructions furnished. Free information on many other 160-6 meter antennas.

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WESTERN RADIO • Dept. A7-4 • Kearney, Nebraska

Dear Sir:

The Korean Amateur Radio League and the Eighth United States Army Radio Club will jointly sponsor a Field Day from 0001 GMT 3 July to 2400 GMT 4 July 1965. A special QSL card will be issued and all amateurs are encouraged to participate. Listening for 20 meters phone will be on 14.200 MC and above and transmission on 14.185 mc and above. Operations will also be on 15, 40 and 80 meters. AM, SSB and CW will be utilized. The station in each U. S. call area contacting the most HL or HM stations will receive a special certificate. The Kimchi award will also be granted for two way contacts with five HL stations. Send extract of logs to HL9US, HQ EUSA, Signal Officer, APO San Francisco 96301.

C. M. Moorfield
HL9KG/KH6FIG

Dear Wayne:

In September of 1964 the first licenses for the Americans on Ascension Island, South Atlantic Ocean were granted by the local government. About December we formed a club called the AARL (Ascension Amateur Radio League) of which I was elected first president. At present there are about 15 licensed amateurs on the island of which there are about six who are active. I guess you have heard some ZD8 activity and this is the brief story.

Unfortunately, BCI, Hi-fi itis and tape recorder interference has kept most of us fairly inactive We live in barracks here and in order to keep peace among our coworkers we do limit our operation when we have interference problems. We'd like to eliminate this interference and maybe increase the activity from the DX spot.

Ascension Island is about 32 square miles in size. It is of volcanic origin and the soil that does exist is not very conductive for grounding purposes. The barracks area is located about 1 mile from the ocean so there is no way to throw a positive ground into the ocean. The ground that we have to use is an instrumentation ground that is run between all the barracks and various sites that are scattered all over the island. This common loop and ties of ground is finally connected to the ocean at about 5 places around the island. There is also a power ground that runs to all the buildings, which is supposed to connect to the instrumentation ground, which depending upon the point it is measured will show a voltage between this power ground and the instrumentation ground. This is the real problem, the ground system or lack of an efficient one.

I have put much work into trying to eliminate this interference. My transmitter is a DX-60 and I have a Drake 2B also. Presently I'm using a long wire with a tuner but hams using a dipole with coaxial lead experience similar difficulties as I do. While my station has been operated by the other hams, I have made measurements with the Heathkit Tunnel Dipper to get an idea of my field strength. I find that I lose the signal or it drops off sharply after 100 ft away from the shack or antenna that is until I bring the dipper near a power line and then the signal shows up strong. I know that the signal is being transmitted all around the base area this way as you may say that we have effectively a floating ground system which is being loaded by our transmitters. Even using the five six foot ground that I have outside my room this still occurs. One ground rod gave between 200 to 300 ohms difference between it and the base ground and with the fourth and fifth it remains close to 30 ohms difference. One of the members seems to recall an article in your magazine about an artificial ground system and I'd appreciate a copy of this, if available, so that we may try this and see if it helps our situation any.

Maybe I have made this sound a little worse than it actually is. There are some sets that have been cured of interference by the standard methods of 0.01 across each side of the line to ground and also by something like a 100 pf from the first audio to ground, but there are still enough sets that still experience interference and cannot seem to be completely cured by conventional methods.

Your help will be appreciated by many and I hope that it will enable ZD8 land to become a bit more active. Thank you.

Ralph ZD8RF

AMATEUR TELEVISION is the EXCITING NEW FRONTIER
GO ON THE AIR NOW WITH A VANGUARD MODEL 440 TV CAMERA

$149.95

VANGUARD Model 440

only **$149.95** less Vidicon and lens.
F/1.9 lens with focusing "C" mount—$18.95

Type 7038 Vidicon	
Grade A	$85.00
Grade B+	$75.00
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Note: Grade C may be any type Vidicon new or used of our choice. Guaranteed to give satisfactory service for amateur use.

Save $3.95. Camera with lens and Grade A Vidicon only **$249.95.**

The VANGUARD Model 440 is built to the same rugged specifications as our Model 400 industrial camera and is complete with self-contained synchronizing generators, 4 mc. video amplifiers, power supply, tripod base, and TV transmitter with output in the 436-450 mc. band. You can transmit over short distances with the output from the camera or drive a simple linear amplifier for any power you want. Sensitivity from one foot-candle to bright daylight using our vidicon and lens. Picture sharpness guaranteed to be equal to the best capabilities of any standard 525-line TV receiver. Modular construction and printed circuits permit quick replacement and servicing of major circuits. Weighs 12 lbs.—measures approximately 8¼" x 6" x 6".
Model #440-X with crystal-controlled horizontal scan available for only $20.00 more.

Building your own TV camera? The following assembled and tested circuits will save you much time and money.

POWER SUPPLY with tripod plate—**$28.00.**
SWEEP and SYNC. GENERATOR. Tested and complete with tubes—**$18.00.**
VIDEO AMPLIFIER with **MODULATOR** and **R.F. STAGE. for 436-450 mc.**
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FOCUS COIL and **DEFLECTION YOKE.** Professional quality with full shielding and cosine wound yoke. Complete with vidicon signal ring contact, yoke and tube clamp —**$36.00.**

More parts available—send 10c for complete catalog.

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VANGUARD TRANSISTORIZED CONVERTERS

New series 300 with 3 VHF-UHF transistors, crystal-controlled oscillator, tuned R.F. stage and low noise mixer. One microvolt sensitivity. More than 30 high quality parts carefully assembled and tested. Measure only 3" x 2½" x 2". Operate at 12 volts DC 4-5 ma.

Available in the following modules:

	Model	Input mc.	Output mc.	Price
2M	300-D	144-148	50-54	**$12.95 ppd.**
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6M	300-B	50-51	.6-1.6	**$10.95 ppd.**
	300-C	50-54	14-18	**$10.95 ppd.**
	300-J	50-52	28-30	**$10.95 ppd.**
20M	300-G	14.0-14.35	1.0-1.35	**$10.95 ppd.**
CB	300-A	26.965-27.255	1.0-1.29	**$10.95 ppd.**
WWV	300-H	5.0	1.0	**$11.95 ppd.**
Int'l.	300-I	9.0-10.0	.6-1.6	**$11.95 ppd.**
CHU	300-K	7.3	1.0	**$11.95 ppd.**
CHU	300-L	3.35	1.0	**$11.95 ppd.**
Marine	300-M	2-3	.6-1.6	**$11.95 ppd.**
Aircraft	300-N4	121-122	.6-1.6	**$13.95 ppd.**
	300-N5	122-123	.6-1.6	**$13.95 ppd.**
Fire, Police etc.	300-P	155-156	.6-1.6	**$13.95 ppd.**
CUSTOM MADE	300-X	Choice of 1 input freq. and 1 output freq. between .6 mc. and 160 mc.		**$14.95 ppd.**

All above converters are supplied with Motorola type connectors. For two SO-239 connectors instead, add 75c. N.Y.C. residents add 4% sales tax.

Nuvistor converters available from $10. Circuit modules and government surplus equipment also available. Send 10c coin or stamps for complete catalog.
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BIG performance—
little money!

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ARE YOU RUNNING A KW ON TWO?

Very few are, but—

How about getting the signal OUT?

We have an antenna that does that. With 20 db over on the front, we have only 4 S units on the sides and 3 S units from the back. By using a new design in reflectors we push all the signal towards the front end where it can be used. The beam is a seven element job with two more reflectors than usual (for a total of nine elements) with a special phasing cable that ties both dipoles together. It uses RG-8/U (52 ohm) cable.

Get one and work that DX station! **$19.50.**

For even better results, get a pair with matching hardware and harness for only **$45.**

Send check or money order. Antennas shipped prepaid in U.S.A.

Money back guarantee—if they do not work as stated.

FULTON ELECTRONICS

Manteca, California

W2NSD/1 from p. 2.

letters, not me, and he, not me, is thus immune from legal action.

If you are interested in getting a copy of the K6BX Extra News Letter #21, twenty-two large sized pages typed three columns to the page with Clif's extra small type, and packed with dynamite which may sweep the present headquarters heirarchy out of office, then send 50c for each copy (buy several and get the word spread) to K6BX, Box 385, Bonita, California.

Columns in 73? No, no, no, no, no, no!

Yes.

I can't fire 80% of you just because you disagree with me, and that was the percentage that answered the February questionnaire with suggestions for columns. Why you want me to louse up a good ham magazine with that sort of junk I can't imagine, but you do and I will and you'd darn well better keep reading the magazine after it gets junked up. As a matter of fact, you should make it your business to talk some friends or enemies into subscribing to make up for any of the 20% who wanted the magazine to stay the same that drop out in medium or low dudgeon.

What columns are we going to sprout? Well, I really don't know. That all depends upon our finding volunteers to write the columns. I figure that we really should have top experts for each field we try to cover. For instance, our propagation column is prepared by John Nelson who is recognized to be one of the foremost experts in the world on radio propagation. The Bureau of Standards only wishes that they could predict as far ahead and as accurately as John does in 73. His predictions have, time after time, been startlingly accurate when compared to predictions in other magazines.

Since 40.0% of you have requested a VHF column we obviously should have something along this line. I really don't know who should run the department. I'll try to come up with someone interesting. 32.4% requested a column on transistors. Hmmm. I guess we're in a good position to turn out something like this ourselves. Watch for a transistor column headed by Paul Franson WA1CCH, who also masquerades as Assistant Editor around here.

Before you get all excited over 73 filling up with all of this special interest stuff, let me explain what I actually have in mind. Rather than running two, three or four pages each month on each subject it seemed to me that we might be able to present the latest news of interest in something fairly short and

concise . . . something quite akin to the Station Activities segment of QST in looks, though one would certainly hope that it would be more interesting in content. If we devote about a half page to each column then the whole works shouldn't take over two or three pages about the same as other magazines devote to one single column.

Club Stations

The following exchange of letters will be of interest to all ops who plan to operate a club station or to operate any multi-operator station in any contests in the future.

Institute of Amateur Radio
26 January 1965

Secretary
Federal Communications Commission
Washington, D. C.

Dear Sir:

The Institute of Amateur Radio, Inc., a non-profit New Hampshire corporation with somewhat over 2500 licensed amateur members is planning on applying for a club station license with myself, the Secretary of the Institute, as trustee.

May I please have your decision on whether it will be legal for the Institute to permit operation of the club station by operators other than the trustee of the station with the trustee not in control of the station?

May I also have your decision on whether it will be legal for the Institute to permit operation of the club station by paid amateur operators?

I assume that both of these are legal since the precedent has been established by the ARRL with their station W1AW, but I wanted to be sure before any great investments were made in equipment and antenna arrays.

Yours truly,
Wayne Green W2NSD/1
Secretary
Institute of Amateur Radio

FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C.
20554
February 9, 1965

Mr. Wayne Green, Secretary
Institute of Amateur Radio
Peterborough, New Hampshire

Dear Sir:

This is in reply to your letter dated January 26, 1965, concerning operations in the Amateur Radio Service.

You are advised that, to meet his responsibility, the trustee of an amateur club station is not required to personally suprevise and control all operations under the club's call sign. Instead, the trustee may delegate certain supervisory activities to a station manager or to other responsible club members. This leeway is permitted since the nature of a club's station operations often renders it impractical for the trustee to be in a position to exercise direct control at all times. The trustee is, however, expected to be able to assume direct control of the club station if it should prove necessary or expedient. He should also generally supervise operations by checking the station log, testing the equipment, assuring that the station is inaccessible to unauthorized persons, etc.

An amateur operator who has a pecuniary interest in his license or who receives material compensation for operation of an amateur radio station is in violation of the Commission's rules and is, therefore, subject to the imposition of severe administration sanctions.

Very truly yours,
Ben F. Waple
Secretary

CRYSTALS IN SUB-MINIATURE HERMETICALLY SEALED HC-18/U METAL HOLDERS. Half the size of a HC-6/U crystal. These crystals have wire leads 1½ inches long. CRYSTALS SELL AT $1.05 each postpaid USA. Ideal for transceivers and limited space applications. All crystals fully guaranteed. The following listed frequencies shipped immediately.

Quantity available				Frequency in Mcs.		
16.000	16.250	16.500	16.750	17.000	17.250	17.500
17.750	18.000	18.250	27.000	27.250	27.500	28.500
28.750	29.000	29.250	29.500	29.750	30.000	32.75
33.000	36.050	36.100	36.150	36.200	36.250	36.300
36.350	36.400	36.450	36.500	48.050	48.383	48.716
49.050	49.383	49.716	50.050	51.050	51.383	51.716
52.050	52.383	53.0075	53.050	53.383	53.2575	53.3075
53.7075	53.716	53.7575	53.8075	53.8575	53.9075	53.9575
55.050	55.383	64.992	65.992	66.992	67.992	68.992
69.992	70.992	71.992	72.992	73.000	75.000	78.000
79.000	80.000	81.000	82.000	83.000	84.000	85.000
86.000	87.000	88.000	89.000	90.000	96.000	97.000
98.000	99.000	100.000	101.000	102.000	102.86	103.06
103.26	103.26	103.46	103.66	103.86	104.06	104.26
104.46	104.66	107.000	111.000			

Limited quantity.

25.750	25.250	32.500	33.250	50.716	61.050	74.000
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SAME CRYSTALS AS ABOVE. SAME PRICE. THIS LIST OF CRYSTALS IS AVAILABLE. HOWEVER I CANNOT SHIP UNTIL 10 DAYS AFTER RECEIVING YOUR ORDER. LISTING MAY NOT BE IN ORDER SO DISREGARD SEQUENCE.

Available in Quantity				Frequency in Mcs.		
14.000	14.050	14.100	14.150	14.200	14.250	14.300
14.350	14.400	14.450	14.500	14.550	14.600	14.650
14.700	14.750	14.800	14.850	14.900	14.950	16.950
17.000	17.350	17.450	17.550	17.650	17.800	17.850
23.500	23.750	24.000	24.250	24.500	24.750	26.250
26.500	26.750	27.750	28.000	28.250	30.250	30.500
30.750	31.000	31.250	31.500	31.750	33.100	33.200
33.300	33.400	33.500	33.600	33.700	33.800	33.900
36.550	36.600	36.650	36.700	36.750	36.800	36.850
36.900	36.950	41.000	41.050	41.100	41.150	41.250
41.200	41.300	41.350	41.400	41.450	41.500	41.550
41.600	41.650	41.700	41.750	41.800	41.850	41.900
41.950	42.050	42.150	42.250	42.450	42.550	42.650
42.750	42.850	42.950	42.400	44.740	45.50	46.240
46.400	53.0575	53.1075	53.1575	53.2075	53.3575	53.4075
53.4575	53.5075	53.5575	53.6075	53.6575	54.050	54.383
54.716	55.716	56.050	57.716	60.050	73.992	74.992
75.992	76.992	77.992	78.992	79.992	80.992	81.992
82.992	83.992					

JUST ARRIVED — CRYSTALS IN FT-243 TYPE HOLDERS. — CRYSTALS SELL AT $1.05 each postpaid USA. Frequency Tol. .05%. All crystals fully guaranteed. Quantity available.

1900	1905	1910	1915	1920	1925	1930	1935	1940	1945
1950	1955	1960	1965	1970	1975	1980	1985	1990	1995
2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
2050	2055	2060	2065	2070	2075	2080	2085	2090	2095
2100	2105	2110	2115	2120	2125	2130	2135	2140	2145
2150	2155	2160	2165	2170	2175	2180	2185	2190	2195
2200	2205	2210	2215	2220	2225	2230	2235	2240	2245
2250	2255	2260	2265	2270	2275	2280	2285	2290	2295
2300	2305	2310	2315	2320	2325	2330	2335	2340	2345
2350	2355	2360	2365	2370	2375	2380	2385	2390	2395
2400	2405	2410	2415	2420	2425	2430	2435	2440	2445
2450	2455	2460	2465	2470	2475	2480	2485	2490	2495
2500	2505	2510	2515	2520	2525	2530	2535	2540	2545
2550	2555	2560	2565	2570	2575	2580	2585	2590	2595
2600	2605	2610	2615	2620	2625	2630	2635	2640	2645
2650	2655	2660	2665	2670	2675	2680	2685	2690	2695
2700	2705	2710	2715	2720	2725	2730	2735	2740	2745
2750	2755	2760	2765	2770	2775	2780	2785	2790	2795
2800	2805	2810	2815	2820	2825	2830	2835	2840	2845
2850	2855	2860	2865	2870	2875	2880	2885	2890	2895
2900	2905	2910	2915	2920	2925	2930	2935	2940	2950
2955	2960	2965	2970	2975	2980	2985	2990	2995	2945
3000	3005	3010	3015	3020	3025	3030	3035	3040	3045
3050	3055	3060	3065	3070	3075	3080	3085	3090	3095
3100	3105	3110	3115	3120	3125	3130	3135	3140	3145
3150	3155	3160	3165	3170	3175	3180	3185	3190	3195
3200	3205	3210	3215	3220	3225	3230	3235	3240	3245

THE ABOVE LISTED CRYSTAL FREQUENCIES ARE IN KILOCYCLES

LOW FREQUENCY CRYSTALS IN FT-243 TYPE HOLDERS. Crystals sell at $1.05 each postpaid USA. All crystals fully guaranteed.

Limited quantity available. Freq. in Kcs. Give 2nd choice select

1005	1010	1020	1055	1070	1090	1170	1200	1235	1240
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CRYSTAL OVEN — LARGE SIZE — PLUGS INTO 5-PIN TUBE SOCKET. ACCEPTS 1" x 1" TYPE BLANKS. FREQUENCY CAN BE ADJUSTED BY TURNING PRESSURE TYPE ADJUSTMENT SCREW. CAN BE TAKEN APART SO NEW BLANKS CAN BE USED. HEATER VOLTAGE 6.3 V. THERMOSTATICALLY CONTROLLED. IDEAL FOR EXPERIMENTING AND ECT. ONLY $1.50 each postpaid USA.

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PANADAPTER Convert this IP69C/ALA2 per June 1964 issue 73. New with tubes. **$22.50**
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Tubes				Tubes	
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Send for Catalog #131 — FREE —

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2534 S. MICHIGAN AVENUE
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JUST RECEIVED——SPECIAL BARGAINS

BC-453 190-550 KC rec. used, very clean, with DM-32A, 24v DC dynamotor **$15.50** **$16.00**

R77/ARC-3 100-156 MC, 8 channel, crystal controlled rec. with tubes, internally complete, & schematic, ex. used. **$17.50**

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RT18/ARC-1 100-156 MC, 8 channel, crystal controlled, transceiver (2-er). Internally complete, two 832A, all tubes, less dynamotor. With schematic, conversion booklet, ex. used **$25.00**

RT82/APX-6 Transponder. Get on 1215 mc quickly. Excellent used, less all tubes. **$10.00**

Antenna Collapsible, 4 section, 4 to 10½". ⅛" tapering. Chrome plated. For field strength meter, transistor radio; BRAND NEW 4 for $1.10 **29c ea.**

5000 mfd. 35v DC lytic, 2" dia. 4½" high, take-outs, **50c** ea; 6/$2.75

9 pin, shield base, ceramic miniature sockets, NEW, **23c** ea; 5/$1.00

9 pin, shield base, **TEFLON**, miniature sockets, NEW, **29c** ea; 4/$1.10

7 pin, ceramic wafer socket, for 832, 829, 826, etc. SYL. NEW **79**, 4/$3.00

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TUBE OVERSTOCK

I'se tired of lookin at 'em! Bigger savings.
6DQ5* was $1.75—now **$1.35**; **5933*** (807W) was $1.50-now **$1.25**; **1616** was $1 now **89c**
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6AK5*; **6AG5***; **6AL5***; **6AQ5***; **6AU6*** **12SX7** (selected 12SN7GT); **12A6**
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955; **957**; **76**; **1626**; **12C8***; **6K7***; **6H6***; **717A***; **6SH7***; **12SH7***; **7193***
*Pull outs from unused equipment. Fully guaranteed.

Others BRAND NEW. Minimum tube order $3.00

SAVE YOUR LOOT—bring it to (I'll have a load of GOODIES): Swapfest, DeKalb, Ill. May 2 Hamfest, Sullivan, Ill. Apr. 25.

All orders, except in emergency or I'm at a hamfest, shipped same day received. For free GOODIE" sheet, send self addressed stamped envelope—PLEASE, PLEASE—include sufficient for postage & insurance. Any excess returned with order.

B C Electronics
Telephone 312 CAlumet 5-2235
2333 S. Michigan Ave. Chicago, Illinois 60616

February 12, 1965

Secretary
Federal Communication Commission
Washington, D. C.

Dear Sir:

Your letter of February 9, 1965 would seem to indicate rather unarguably that an amateur may not operate an amateur radio station for pay.

Yet I am faced with the seeming contradiction of the operation of amateur radio station W1AW, the official station of the American Radio Relay League, Inc. W1AW has been in operation for many years with, I must assume, paid operators. Of course there is always the possibility that some sort of transparent fiction has been used to circumvent the law.

Please tell me under what arrangement W1AW is able to operate with paid amateur radio operators so that the Institute of Amateur Radio, Inc., a non-profit New Hampshire corporation for the benefit of amateur radio, can establish its own official club station for use in transmitting code practice and messages of specific interest to all radio amateurs.

Very truly yours,
Wayne Green W2NSD/1
Secretary
Institute of Amateur Radio, Inc.

As you can see, the FCC has decided, in an interesting exercise of illogic, that although the licensee of an individual amateur station must be in control of the station if his call is to be used, in the case of a club station the club call can be used with all operators. even with the station trustee not present or in control.

Applying this new interpretation of our rules to contest operations, such as Field Day, we find that club calls can be used where the club has a license of its own, but that in cases where the call of a member would normally be used the operators must each use their own call when operating. The ARRL has indicated that they intend to do battle with the FCC on their interpretations of the rules because the new "rules" will cause considerable difficulty to their contests and awards. Tsk, tsk.

$100 Reward

The slides I took while DXpeditioning on Navassa during the KC4AF operation are of great sentimental value to me and I will pay $100 for their return, no questions asked. Last known whereabouts of the slides: CQ had 'em and refused to part with them.

We Want Money

A letter from one of our authors suggested that I take a quick survey to find out how many other authors are owed money by one of our ham magazines. Apparently one of our competitors is considerably in arrears. If all of you who are owed money for published articles will drop me a note giving the name of the magazine, the month and year published and the name of the article I will try to put together an "arrears" figure and publish it in 73. I will not embarrass you by publishing

TS 418A 400-1000 meg signal generators, AM, PM or CW emission **$325.00**
Baird Atomic 162 Glow transfer counters **$100.00**
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Millivac MV-17C Voltmeter 1mv-1000V **$75.00**
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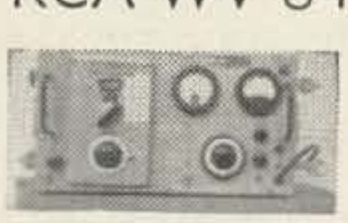
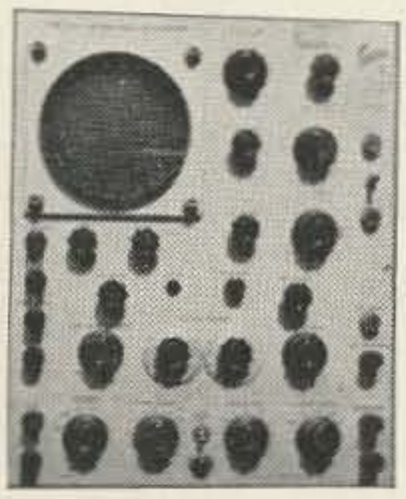


TS-497B 2-400 Meg Signal Generator with manual **$225.00**



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you name or call . . . all I will give will be the total figure reported to me.

Late News

More news on the million dollar libel suit facing Huntoon and ARRL. Last month I reported that an expensive law firm had been retained by the League to fight the case. Now I understand that none other than Louis Nizer is to be their counsel . . . and the last I heard his fees start at around $25,000. Well, the case against them looks formidable to me . . . John really put his typewriter in it this time in a letter to all member clubs (one of his famous "Dirty Letters") and the entire League has to pay for this blunder. Watch for full details in QST . . . hi.

I understand that three Directors are shopping for a new general manager.

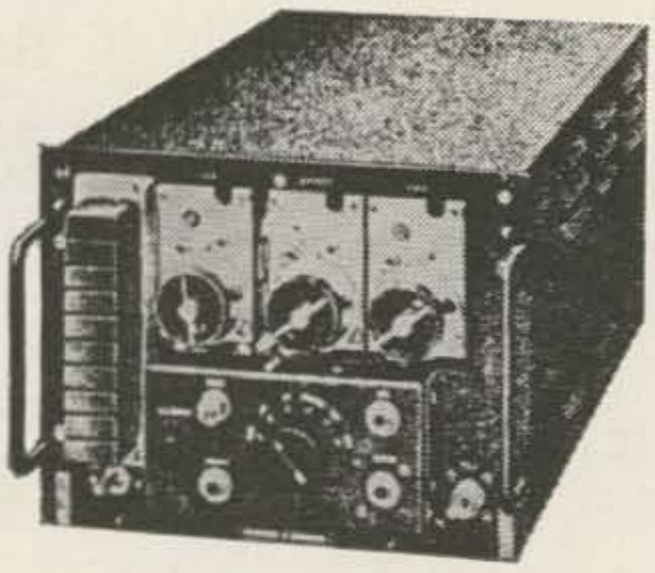
Re RM-499 . . . no new news. All is quiet. Stay that way.

Our DX column starts this month on page The mails permitting, we will have a month- letter from Gus telling us what major things are going on and what he is hearing from up here is Bhutan. I never would have suspected that anyone would have a DX column edited from AC5 land. . . . Wayne

AIRDUX #195-2 1KW PI DUX Assembly $14.50 value for $4.50
Sarkes Tarzian F-6 Sil. Rect. (1N2484) new 600 PIV 750 MA. 10 for $3.75
Meters, 2⅜" square, White fig. Blk. Backgrd.
Marked "Plate Current" 0-200 ma. $3.25
"S-Units" 0-60 ma. 3.25
Dial Plates, 1⅞" Dia. Aluminum, Black Nos. 0 to 100 in 180 degrees $1.00/Doz.
Crystals, CR-23—10005.000KC, 16105-000KC, 20505.000KC, 27505-000KC, 34505-000KC, 35005.000KC, 35505.000KC, 36005.000KC 85c ea.
5894 tubes, New $6.50, with socket $7.25, socket 85c
2 Meter Coax Band Pass Filter, Brass, Silver Plated, Hi-Q, will also tune to 1.4 meters $8.75 Prepaid
4 inch National Co. "Velvet Vernier" dials, 5-1 ratio $1.75
2 inch Meter, 500 microamps $2.25
4X150As pullouts $3.50
4CX300As pullouts $11.50
With SK-711 socket $ 16.50
With SK-711 socket only $7.50
JFD Piston Trimmer Caps Type QS-173, 0.6 to 5.5 mmf $8.25 value each, New original Pack 20 for $9.00
Hewlett Packard 475B tunable Bolometer Mts. $75.00
General Radio 667A Inductance Bridges $135.00
Waterman S-14-A Pocketscopes New $249.50
Our price used $89.50

Government Warehouse, Inc.
264 Shrewsbury Ave., Red Bank, N. J.

ARC-1 for 2-meters



ARC-1 Navy Surplus Transmitter Receiver Xmtr, uses 832A in final, 20 watts input, with AM push-pull plate modulation. Ten crystal controlled channels. Freq range 100-156 Mc. Receiver has extra, separate guard channel which can be tuned for your net frequency. Complete with tubes, schematic diagram, and conversion instructions for AC power supply and tunable oscillator. Shipping wt. 50 pounds. Used good. **$24.95**

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115 volts, 60 cycles input. Including transformer, silicon rectifiers, punched chassis, and all necessary parts. Fits inside ARC-1 case. Shipping wt. 10 pounds. **$19.95**

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UG-201A/U Tflon. Adapts BNC plug to type N jack. **$1.05**
UG-273/U. Adapts BNC plug to SO-239 jack. **87c**
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RTTY: 3620, 7040, 7140, 14090, 21090 kc.
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432mc: 9 PM Wednesdays
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Patch: CE, CO, CP, EL, HC, HH, HI, HK, HP, HR, OA, TI, VE, XE, YN, YS, YV, ZP and KB-KZ.

VHF-UHF

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Quig

Sprague is giving a little bonus with their Atom Electrolytic Capacitors. These little connectors fit on cut leads for easy repairs. They are small springs made of a special wire that has a copper-covered steel core, a layer of flux and an outer jacket of solder. They're mighty good for initial wiring and replacement of parts in almost inaccessible places.

Solution to puzzle on p. 80

T	R	A	C	E	R	■	S	W	■	A	D	S
O	C	T	O	D	E	■	P	I	■	P	I	E
P	A	T	■	S	E	P	A	R	A	T	O	R
■	■	E	L	■	D	A	R	E	S	■	D	I
B	O	N	A	■	■	W	K	S	■	L	E	E
P	L	U	M	B	I	N	G	■	M	A	S	S
■	■	A	P	E	R	■	A	H	E	M	■	■
S	I	T	S	■	O	P	P	O	S	I	T	E
O	N	E	■	■	N	A	■	C	O	N	E	S
C	S	■	F	O	C	U	S	■	N	A	■	■
K	I	L	O	V	O	L	T	S	■	T	E	E
E	D	B	■	E	R	■	U	N	B	E	N	T
T	E	■	■	N	E	■	B	R	I	D	G	E

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16	□□ .45	□□ .65	□□ .75	□□ .90
25	□□ .75	□□ .85	□□ .95	□□ 1.10
50	□ 1.60	□ 1.90	□ 2.30	□ 2.80

D.C. AMPS	300 PIV 210 RMS	400 PIV 280 RMS	500 PIV 350 RMS	600 PIV 450 RMS
7	□ .79	□ .95	□ 1.05	□ 1.29
16	□□ 1.10	□□ 1.35	□□ 1.50	□□ 1.70
25	□□ 1.20	□□ 1.50	□□ 1.70	□□ 1.90
50	□ 3.50	□ 4.20	□ 5.25	□ 7.00

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50	□ .85	□ 1.20	□ 1.40	300	□ 2.60	□ 3.00	□ 3.40
100	□ 1.35	□ 1.80	□ 2.20	400	□ 2.90	□ 3.25	□ 3.75
150	□ 1.60	□ 2.10	□ 2.65				
200	□ 1.75	□ 2.40	□ 2.90				

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□ 2N1132*	.6	35	to 90	100	*pnp, others npn

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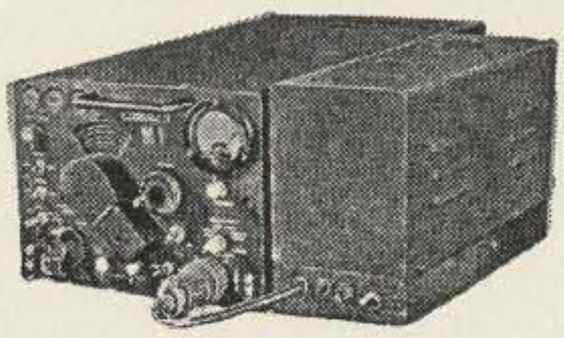

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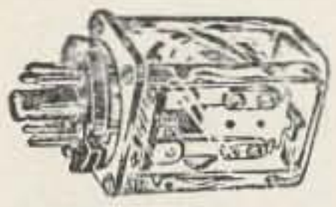

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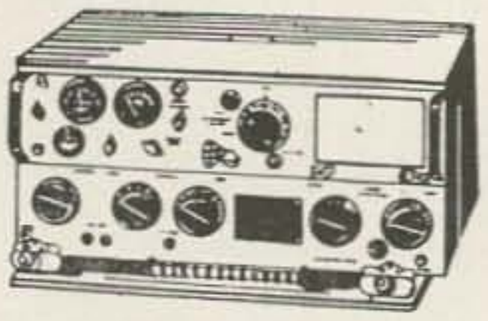

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INDEX TO ADVERTISERS

Alco, 82
Algeradio, Jan. 65
Alltronics-Howard, 82
Ameco, 83
American Crystal, 83
Amplidyne, Feb. 65
Amrad, 84
Arrow Electronics, Dec. 64
Arrow Sales, Chi., 88
Atlantic, Oct. 64
ATV Research, Mar. 65
Aztec, Jan. 65
Babcock, 40
Barrett, Dec. 64
Bc Electronics, 88
Budwig, 68
Burghardt, 57
Burstein-Applebee, Jan. 65
B & W, Mar. 65
Callbook, 78
C & H, Feb. 5
Columbia, Mar. 65
Cornell-Dubilier, Jan. 65
Cubex, Jan. 65
Cushcraft, Cover II
Datak, Feb. 65
Dayton Hamfest, 64
Davco, 41
Denver Crystals, Feb. 65
Denson, Jan. 65
Digication, Nov. 64
Dow Key, Mar. 65
Dow Trading, 82
Drake, 15
East Coast, Jan. 65
Editors & Engineer, 35
Edwards, 73
Electronicraft, Jan. 65
ESL, Dec. 64
Ell-Comm, 79
Evans, 71
Fair, 68
Fichter, 68
Finney, 20
F-M, Dec. 64
Fulton, 86
Gain,
Galaxy, Mar. 65
Gem Electronics, Feb. 65
Gift Shop, 84
G & G, Feb. 65
Glass, J. J., Mar. 65
Gonset, Feb. 65
Goodheart, 93
Government Whse., 89
Graham Radio, 82
Hammarlund, Mar. 65
Hayden, 79
HCJ, 81
Heffron, 89
Henry, 69, 77
Hill, Feb. 65
Hi-Par, 75
Hi-Way, Nov. 64
Hotel Rex, Mar. 65
Hy Gain, Dec. 64
Internal Xtal, 5
Jefftronics, 90
Juge, Mar. 65
Justin, Nov. 64
Lafayette Radio, Dec. 64
Linear Systems, Mar. 65
Mann, Mar. 65
Marina, 83
Master Mobile, 45
Meshna, 94
Mission, 47
Mor-Gain, 72
M & W, Dec. 64
Mosley, Mar. 65
National, Cover IV
Newtronics, 13, 63
Parks, 90
Path, 71
Poly-Paks, 91
Quaker, 87
Quement, 55, 65
Reyco, Mar. 65
Rohn, 4
RW Electronics, 82
Salch, Mar. 65
Saxton, Dec. 64
Scientific Asc., Mar. 65
Selectronics, Feb. 65
Sideband Engineers, 42, 43
Skylane, 84
Space, 83
Spitz, Dec. 64
Squire-Sanders, Oct. 64
Sterman, 36, 50, 61
Super-Q, Dec. 64
Swan, 33
T A B, 95
Technical Material, Dec. 64
Telrex, 18, 49, 68
Tepabaco, Dec. 64
Texas Crystal, 9
Transistors Ult., Mar. 65
Tri-Ex, 21
U. T. C., Mar. 65
Vanbar, 79
Vanguard, 85
Viking, Mar. 65
Waters, 19
Western (Calif.), 83
Western (Neb.), 84
Western (Neb.), 84
Wilson, 84
World Radio Labs, 96, Cover III
Yatter, Dec. 64

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NEW 80-40 meter diapole using proven parallel diapole principle to resonate on both bands. Requires only one 52 ohm feed line (coax not supplied). Kit includes wire, insulators, center connector & full instructions. Complete formula supplied & quick graph chart for easy adjustment. May be used on **15 meters also.** SWR: Better than 2:1 at resonance — 80/40. Max. length — 123 ft.; 140 ft. for lowest CW range. Easy to install. Wt. 4½ lbs. Shipped Parcel Post.

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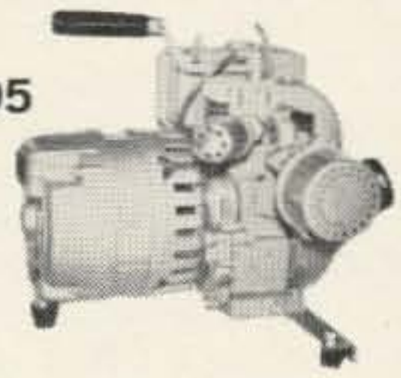

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